

SCIENCE.

FRIDAY, JUNE 27, 1884.

COMMENT AND CRITICISM.

THE new and promising biological department of the University of Pennsylvania has issued a modest prospectus, announcing opportunities for special work, and courses of instruction in biology, open to both sexes. A high ground is taken in its simple 'aim,' which is avowed to be, "to encourage original research in biology by offering facilities to scientists engaged in investigation, and by giving instruction to advanced students prosecuting special work." Besides this principal function, "the department will further conduct the instruction of those students of biology . . . in a course leading to the degree of doctor of philosophy, and of those . . . who have elected the course preparatory to the study of medicine." A suitable laboratory is to be ready by Sept. 1, and is to possess one feature which cannot be too highly commended; viz., "private rooms for the use of investigators." There is as yet no symptom of any attempt to force investigation unduly, and let us hope there never will be. Investigators are born, not made; and now that the first step has been taken in promising them 'facilities,' the next will quickly follow; viz., to supply a stimulus. For this, example is better than any mechanical pressure; and to the faculty we must look for the healthy stimulus of example. Last, but by no means least, the university or its friends should see to it that a moderate pecuniary support shall be obtainable in the shape of fellowships or otherwise; so that poverty may never be permitted to interfere too far with the real investigator.

DURING the past two years, great interest has been manifested in the subject of the unification of time and longitudes the world over. In our own country, the universal adoption, in

November last, of standard time according to a system of meridians distant from that of Greenwich by an exact number of hours, has led to results of great importance in the convenient arrangements and intercourse of ordinary life. Though not at all a matter of necessity, it is still desirable that this system of standard meridians, or some other, shall be adopted everywhere; and, in pursuance of an act of congress, the president of the United States has invited the principal nations concerned to send delegates to a time-convention, to meet at Washington next October, to deliberate upon the question of the adoption of such a prime or zero meridian. By far the greater part of all calculations in geography, astronomy, and geodesy, where a zero meridian is concerned, are, by common consent, referred to the meridian of the observatory at Greenwich, England; so that this meridian stands among the first proposed for universal adoption. The representatives of other governments, however, will undoubtedly have decided preferences for other meridians; and there is much to be said in favor of the adoption of one or another zero point of reference. The interest in this subject is plainly apparent from the fact that nearly all of the invited nations have appointed suitable delegates, whom our own commissioners will at an early date be expected to receive at Washington.

It goes without saying, that the learned men of other lands, thus convened, will expect to see our own nation represented by its highest order of talent, especially as the convention has been called by ourselves. And it is particularly desirable that our own commissioners shall be men of the greatest scientific authority in these matters; for, as the representatives from foreign countries are our guests, they will the more readily accept proposals from our commissioners, should these representatives prove competent to take a very prominent part in all the deliberations of the congress, as

scientific men of the first rank. It may also fairly be supposed that the French language will be more generally spoken by the delegates from all nations; and the necessity of a thorough acquaintance with the French and German languages ought to be duly weighed by those having power to make the appointments of the American commissioners. The power of appointment having been apparently delegated to the secretary of state, no sufficient reason is apparent why this officer, whose appointments to similar positions of responsibility have heretofore been excellent, should have transferred his prerogative, in part, to the secretaries of war and the navy, the former of whom has not yet, it is believed, made his own designation.

The time-convention act provides for the appointment of three commissioners. On general grounds, the appointment of President Barnard by Secretary Frelinghuysen himself is open to no objection; for he has long been interested in these matters, occupies a commanding position, is a scientific man of recognized ability, and has had, in addition, much practical experience in international conferences. His personal disability of extreme deafness ought, however, we think, to have excluded him from membership of the commission, as it will practically prevent his taking a leading and representative part in its deliberations. The second commissioner, already named by the secretary of the navy, is not open to any such objection: but he is practically unknown in science, outside of a limited circle in the United States; and, aside from his being at present on duty at the naval observatory, there is very little reason why he should have been selected for this responsible scientific appointment, rather than any other line-officer of the navy; and, besides, we are credibly informed that he speaks no language but English.

It remains to be seen what name the secretary of war will designate; and it is to be hoped that he may consider well the appoint-

ments already made, and add by his own the strongest possible name to the list of commissioners. Unless we mistake, he is not required to make the appointment from the army, but may select from the ranks of scientific men in general. Had Mr. Frelinghuysen asked the secretary of the treasury for a name, and had he designated the superintendent of the coast-survey to act as commissioner, we should have had an officer in all respects competent to represent the interests of the nation. Nor had any one the power to make a wiser appointment than lay in the way of the secretary of the navy, — to detail the superintendent of the 'Nautical almanac' for this service. This condition of affairs, in so far as the present appointment of the American commissioners is concerned, points to the advisability of additional legislation on the subject. Congress should at once supplement the commission by not less than two additional members, and stipulate that these be recommended to the president (as the original commission might well have been) by the president of the National academy of sciences; thus making the matter one in which the advice of the academy is sought by the government, and which, by its act of incorporation, the academy is required to give. The appropriation of a moderate sum to defray the necessary expenses attending the sessions and records of the deliberations of the convention, ought also to be granted. This, indeed, we understand, has already been proposed.

THE call made by the Peabody museum for immediate funds for the continuation of its explorations in Ohio deserves to meet with a cordial response; and, were the valuable and novel results which are being secured by this exploration more widely known, there would be no doubt as to its success. Probably, for the first time in all the years that have passed since the Ohio mounds and earthworks have excited the curiosity of the people, a thoroughly scientific and exhaustive exploration is making of one locality. This is not merely to collect relics from the mounds, which has heretofore

so often been the single purpose of so-called exploration; nor is it carried out by sinking shafts in the centre of a mound, or cutting a ditch or two through it: but every foot of earth is removed, and the whole structure laid bare foot by foot. This mode of work has led to the discovery of singular and remarkable structures, not only in the mound and at the natural level of the surrounding land, but for six feet beneath this, to the underlying gravel-deposit. These operations have brought so many novel facts to light, that we have now the right to class all former mound-explorations in the Ohio valley as so superficial as to be scientifically worthless, until further thorough work on groups not yet destroyed shall give the means of comparison, and place the partial results that were formerly obtained in their proper relations.

The recent explorations have shown conclusively that the mounds and earthworks in various parts of the country were made at greatly different periods of time, and presumably by different peoples, even should it be ascertained that they all belonged to the great Mongoloid stock, of which our Indians probably represent more than one subdivision. This, however, is not yet proved; and the conclusions that have been drawn from time to time, that there has only been one people on this continent who made the earthworks of various kinds, are too hasty deductions from the present imperfect knowledge of our archeology. That some Indian tribes made mounds and earthworks and fortifications is not to be questioned, and that others did not is probably equally true; but this does not give us the right to throw overboard other facts tending to show that peoples of various stages of development, and, so far as craniological and artistic conclusions can be at present drawn, of distinct ethnical stocks, were also former inhabitants of this continent. One man will class all the past and present native inhabitants of all America, both north and south, as Indians; the next, with equal assurance, will state that the ancient Mexicans, the builders of the stone structures in Yucatan, the old Peruvian and other South-American na-

tions, etc., were races distinct from the North-American Indians; and there have been many variations from these theories.

The fact is, we do not know who the Indians are, or who were the old builders of Palenque, of Uxmal, of Tiahuanuco, and numerous other old cities from Mexico to the eastern side of the Andes in South America. Until we awake to the fact that America has an interesting past, and can arouse ourselves to the effort of making out the ancestors and descendants of all these peoples, who have left us such marked differences in their architecture, their works of art, their customs and their languages, we act the part of amateurs, when from a little knowledge of a few of these different conditions, and from superficial or very general resemblances, we draw hasty conclusions. Only the most thorough explorations, conducted by men who have broad views and careful methods of work, — men who are above being led by theories to be maintained; who will look at facts in the same manner as a geologist or a biologist looks at his facts, letting them lead him where they will, — will solve for us the great problems of American archeology. The days of collectors of curiosities and hasty writers are over. Archeology is a science, and no longer in the hands of the mercenary dealer and the equally avaricious collector of curiosities. Give the proper institutions the support they ask for, and the near future will bring valuable results.

LETTERS TO THE EDITOR.

**** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

Gyration of a vibrating pendulum.

If a body move in any curve about any centre of curvature, the inertia of the body is manifested as a force acting in the plane of the curve, and in a direction opposite to that of the centre of curvature; and if v denote the lineal velocity of the body, and ρ its distance from the centre of curvature, the force thus manifested will be represented by $\frac{v^2}{\rho}$, and is called the centrifugal force due the motion.

If the body move in a straight line on a limited portion of the earth's surface while the earth is rotating on its polar axis, its motion may be regarded, without sensible error, as being on a tangent plane; and because any tangent plane rotates about an axis

normal to that plane, with a constant angular velocity $\omega \sin \lambda$, where ω is the angular velocity of the earth about its polar axis, and λ is the latitude of the normal axis, the path of the body, in space, will evidently be a spiral curve; and from the properties of that spiral, the centrifugal force at its origin, which is the deflecting force resulting from the earth's motion on its axis, is readily found to be $2\omega v \sin \lambda$ (see *Science*, iii. No. 57).

The same result that is here found from the properties of the spiral which the body describes in space was found by Mr. Ferrel from the equations of motion on a spherical surface (see eq. 53, Professional papers of the signal-service, No. viii., 1882, p. 30); but, by assuming that the motion of the body in space is in the circumference of a circle, he finds for the time, τ , of a revolution in that circumference, —

$$\tau = \sec \theta \times \frac{1}{2} \text{ day;}$$

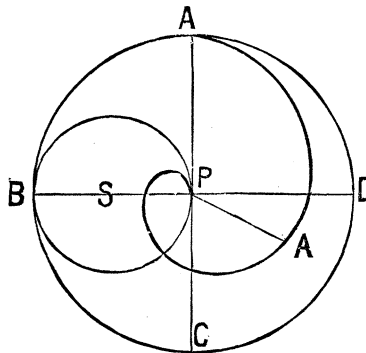
and he says, "The gradual gyration of a vibrating pendulum is caused by this same deflecting force, and hence the time of gyration is the same as that of τ in the preceding equation."

But it is well known that the time of gyration of a vibrating pendulum is $\sec \theta \times 1$ day.

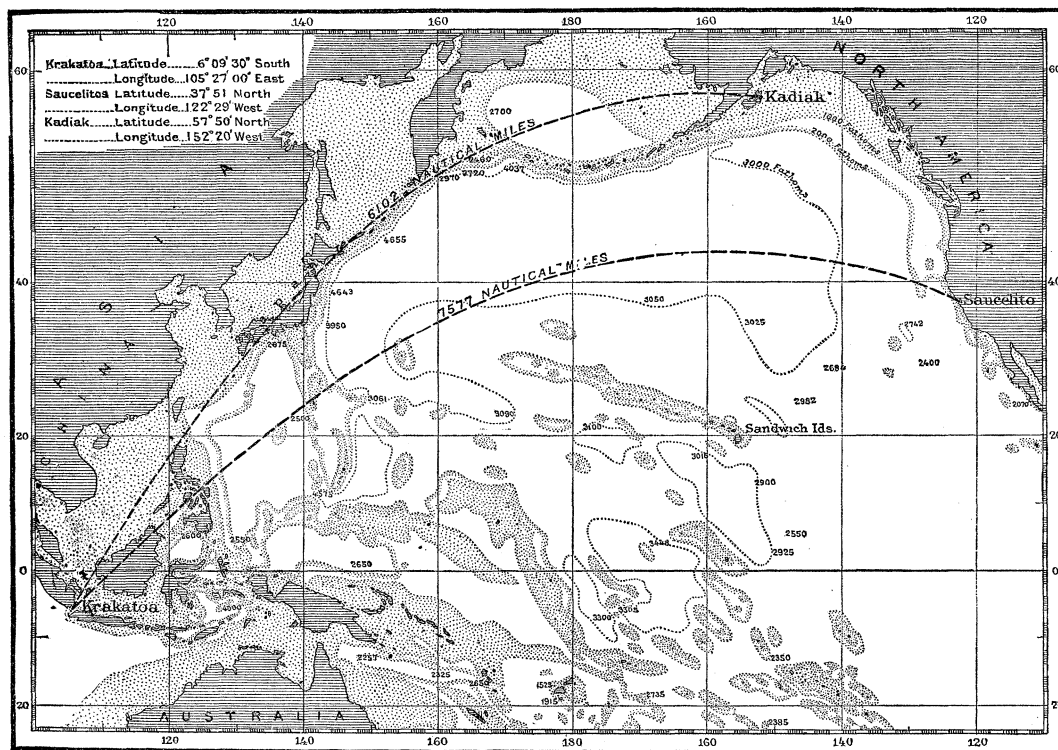
This discrepancy may be explained as follows: —

Let P represent the position of the normal axis or centre of the tangent plane $ABCD$, which therefore

suppose the body to describe the circumference of the circle s by moving along the radius vector PA' , while the radius vector rotates about P , the circumference of s will obviously be described while the



radius vector makes a half-revolution about P ; that is, in the time $\tau = \sec \theta \times \frac{1}{2}$ day. The time τ' of gyration of a vibrating pendulum, however, does not correspond with the time τ in which the circle s would



rotates about P with the velocity $\omega \sin \lambda$, or $\omega \cos \theta$, if we adopt Mr. Ferrel's notation; and because the radius of curvature at P is the same for the spiral $PA'A$ as for the circle s , the centrifugal force at P will be the same, whether the body move in the spiral, or in the circumference of the circle s : but if we

be described, but is the time in which the spiral $PA'A$ is described, and hence —

$$\tau' = \sec \theta \times 1 \text{ day,}$$

as has been abundantly proved by experiment.

J. E. HENDRICKS.

Des Moines, Io., May 20.

Water-waves from Krakatoa.

You published, in May, a couple of interesting communications on atmospheric waves from Krakatoa. As the effect through the water was still more marked and more sharply defined at very great distances, I have made for publication, by authority of the superintendent of the U. S. coast and geodetic survey, reduced photographic copies of the records of the self-registering tide-gauges at Kadiak, Alaska, and at Saucelito, near San Francisco. These copies cover the period from 0h. Aug. 27, to 0h. Aug. 30, or the seventy-two hours during which the tide-gauges show, in a very marked manner, the effect of the Krakatoa earthquake upon the masses of water in the North Pacific Ocean.

It is interesting to notice that the impact of the earthquake was apparently felt earlier and in a greater degree at San Francisco than at Kadiak; although the former is 1,473 geographical miles more distant, in a direct line, from Krakatoa.

The observations at Honolulu, where the U. S. coast and geodetic survey has a self-registering tide-gauge, are expected to arrive shortly, and will help to throw more light on this interesting point.

All this suggests inquiry into the path which the great wave pursued. According to the accepted theory of wave-transmission in deep waters, the time is shortest in the most profound depths, and therefore the tidal register at Honolulu is looked for with great interest. There are evidently several pathways through the great congeries of islands north-east of Krakatoa, and two to the south of Australia,—one between Australia and New Zealand, thence through the Pacific; and the other east of New Zealand, and northward through the Pacific. (See opposite map.)

If it had been possible to maintain the tide-gauge at Mazatlan, it would have afforded very valuable information as to the most probable direction taken by the great earthquake-wave.

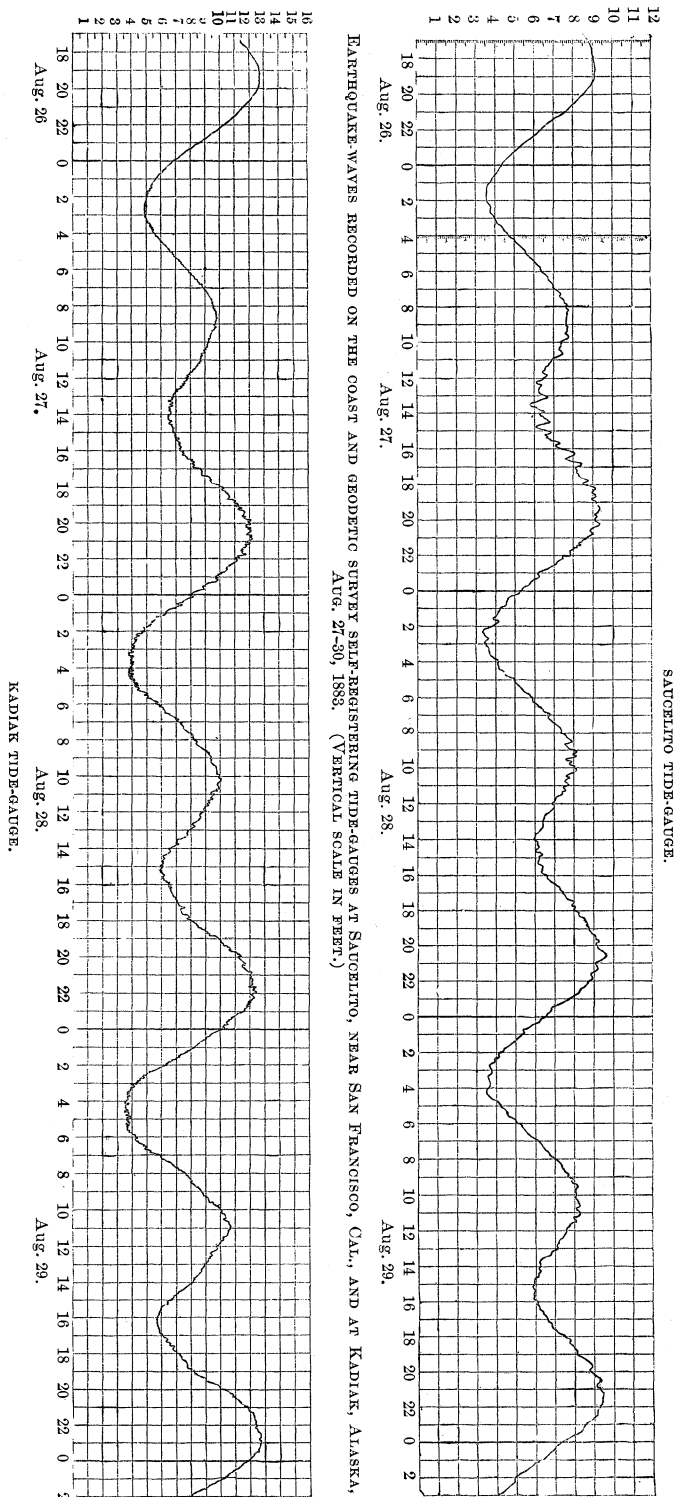
The dates upon the records are given for local mean solar time, 'civil account' at each gauge. The temperatures recorded are of the water at the time indicated. The geographical positions are as follows:—

Krakatoa . . . lat. $6^{\circ} 09.5' S.$, long. $105^{\circ} 27' = 7h. 01m. 48s. E.$
 Saucelito . . . lat. $37^{\circ} 51' N.$, long. $122^{\circ} 29' = 8h. 09m. 56s. W.$
 Kadiak . . . lat. $57^{\circ} 50' N.$, long. $152^{\circ} 20' = 10h. 09m. 20s. W.$

C. O. BOUTELLE,

Asst. in charge of office.

U. S. C. and G. survey,
 Washington, D. C., June 10.



THE U. S. CENSUS OFFICE.

THERE is a popular disposition to belittle the importance of the census, and to underestimate the value of what has been accomplished under the direction of Gen. Walker, which will pass away when the magnitude of the difficulties to be overcome, and the skill displayed in handling such a mass of figures, are better understood by the public. Six volumes have already been issued, which have excited the admiration and enthusiastic approval of statisticians on both sides of the Atlantic. It is said that the whole number of volumes will be nearly twenty, of which some are now in type, others ready for the compositor, and of a part the manuscript copy is not yet fully prepared. The entire series will constitute an encyclopaedia of information, not only as to the population of the United States and its composition and growth, but as to the financial and other resources of the country, and the burdens to be borne by the American people, and will be of the greatest historical value. As an advertisement of the national wealth, and of the rapidity with which this country is assuming a foremost position among the nations of the earth, the tenth census is worth many times its cost; and we are not claiming too much for it when we venture the assertion that no statistical work of equal extent and merit has ever been executed by any nation.

The unpopularity of the census appears to be due, partly to its having exceeded in cost the original estimate, and partly to the delay in the publication of the results. But it is not surprising that Congress was unable to foresee the actual amount of expense involved in so elaborate and exhaustive an inquiry; and the delay in publication is owing to insufficient appropriations from time to time, and the too rapid reduction of the force engaged, which has unduly prolonged the examination and tabulation of the returns. It is probable, also, that the failure to ask and obtain sufficient appropriations has curtailed the proportions of the work, and led to the omission of information which was in fact gathered, and might have been given to the world.

Really it is more than doubtful whether the methods adopted for taking the census do not need to be thoroughly revised, and new methods adopted. It must be a serious loss to the government to do as it does, — to disband the force trained for this special undertaking, and scatter it, once in ten years, and then reorganize it with unskilled and inexperienced clerks, who require to be educated at great

expense before they understand what it is that they are employed to do. No other scientific undertaking is carried on in this way. We assume that the purely clerical portion of the work may be done by untrained clerks, if they are directed by skilled and competent chiefs of division, just as raw recruits may be of service in war, when drilled and commanded by veterans. But it would seem that the office of commissioner or superintendent of census ought to be made a permanent one, and work enough assigned to this bureau to employ a permanent staff of assistants capable of giving impulse and direction to the largely augmented number of clerks required when the decennial enumeration of the population is made. There are many varieties of social statistics which it would be desirable to collect and publish annually; and it is not essential that all the special and occasional investigations which are of national importance should be made at the same moment of time. Why might not the population be enumerated in one year, and the agricultural statistics obtained in another, and so on? Then, too, it is difficult to conceive how a census can properly be made without reference to documents, state and municipal, which should be permanently preserved in a special library under the control of the office, with a librarian charged with the duty of keeping it up, and thoroughly acquainted with its contents and arrangement; which implies a permanent census bureau. Lists of correspondents are also requisite, which should be constantly revised and corrected. The additional expense of a permanent force, which need not be large, would be far less than the waste of money occasioned by the want of thorough preparation for taking the census on the present plan, and the mistakes and misdirected energy of a clerical force destitute of scientific knowledge or skill, unacquainted with each other, and unorganized for effective work.

There must also be improved modes of collecting and digesting information which are practicable. The process of tallying results by hand, so painful and slow, which is at present in vogue, must give way to some other process, involving less mental and manual labor, and increased accuracy. Too many clerks and too much time are required to meet the wants of an active and impatient people like ours. We do not appreciate information which is not recent and fresh. There must be some way devised of utilizing steam or electricity in the tabulation of results. If this can be accomplished, then instead of waiting several years for the published census, as we now have to do,

we might hope to have it on the shelves of our libraries in six months, or a year at most, after it is taken.

These remarks are made purely in the interest of science. Scientific investigation deals, first, with the elementary substances of which masses are composed, then with the forces which are at work to combine them into composite forms, and finally with the relations and principles which characterize and control organisms. Human society is an organism, for the right apprehension of which it is as essential to accumulate facts, and by means of comparison and analysis to deduce the laws which govern social phenomena, as it is to follow the same method of study in any other branch of science. The political and commercial bearings of the census we do not discuss; but it is evident that the census of the population and material resources of this country has for us a special significance, in view of our representative form of government and of the unprecedented growth of the American people. To these considerations may be added another; namely, that no other nation has such a heterogeneous population, and therefore such need of self-introspection, in order to comprehend its true capacity, limitations, and destiny. The political and financial needs of the country minister to science, and promote scientific research in this particular direction. All that scientific men insist upon is, that the investigation shall be in competent hands, and conducted according to the principles and methods which have done so much for science in general. A census bureau, wisely constituted, might, with respect to social science, occupy a relation, and perform a work, similar to that of the Smithsonian institution in the domain of the natural and physical sciences.

HEAD WATERS OF THE ATNA OR COPPER RIVER.¹

VERY little has been known of this river, which enters the Pacific in about latitude 60° north, longitude 145° west. Several prospectors were left there to make explorations last year, and will be called for this summer. The Ah-tena or Atnah Tinneh Indians reside on its banks, and from its bed have been taken numerous pieces of native copper resembling that of the Lake Superior region. The Wrangell Volcano is situated near it, about a hundred miles from its mouth.

In crossing the Chilkat portage from the head

¹ Communicated by authority of the superintendent of the U. S. coast and geodetic survey.

of Lynn Canal to the head waters of the Lewis branch of the Yukon, the head waters of another stream, called the Altsek River, are crossed. The natives allege that this stream falls into the sea; and on Tebienkoff's charts the mouth of the Altsek River is placed on the ocean-coast just north-west from Mount Fairweather, in the bed of the Grand Plateau Glacier. The observations of the U. S. coast-survey party, under my charge, in 1874 showed that no river from the interior could enter the Pacific between Cape Spencer and Yakutat Bay; all the depressions of the St. Elias Alps being filled with glaciers. In recent charts the Altsek has therefore been connected by a dotted line with the White River, one of the branches of the Yukon. I have for some time suspected that the Altsek was the head of the Copper or Atna River, but until lately have had no evidence sufficiently weighty to make it desirable to alter the charts. A recent letter from Dr. Arthur Krause states that his Indian guides told him that they had descended the Altsek to salt water, where there was a small village of Tlinkit Indians. This makes it certain that the Altsek and Atna rivers are continuous; for the Chilkhaat village at the mouth of the Atna is the only one answering to the situation, and the westernmost of all the Tlinkit villages, being separated from most of the others by a wide stretch of unoccupied coast.

This determination is of much importance. It determines the Atna River to be over four hundred miles in length, and the longest river falling into the Pacific between the Fraser in British Columbia and the Aliaskan peninsula. The opportunity for a most interesting exploration is here evident. The explorer need only take a couple of good canoes or portable boats up the Chilkat River, and across the portage to the Altsek, and float down the latter. Within a couple of days of the mouth of the Atna is the trading-post of Fort Constantine at Port Etches, commonly known as Nuchek, where supplies could be had and arrangements made for the trading company's vessel to convey the party to St. Paul, Kadiak Island, whence transportation to San Francisco could be had without difficulty, at some time during the autumn.

WM. H. DALL.

THE ETOWAH MOUNDS.

IN *Science* of April 11 is an article by Mr. W. H. Holmes, on certain engraved shells and figured plates of copper found in southern mounds. As some of the most interesting of these articles were obtained from one of the

mounds forming the celebrated Etowah group near Cartersville, Ga., a description of the form, structure, and contents of this tumulus may be of interest to those who have read Mr. Holmes's article.

As this group has been repeatedly described and figured (see Jones's 'Antiquities of the southern Indians,' chap. vi., pl. i.; and an article by Col. Whittlesey in the 'Smithsonian report' for 1880, p. 624), it will be unnecessary for me to add more in this regard than to correct one or two errors.

The dimensions of the large mound marked *A* in the figure alluded to, as ascertained by the assistants of the Bureau of ethnology, are as follows: the slant height along the steepest slope, which I found by personal examination to be just about 45° , is eighty-five feet, giving a perpendicular height of sixty-one feet; the longer diameter of the level top a hundred and seventy-five feet, and the shorter a hundred and seventy, giving an area of about

the original surface of the ground, sixteen feet. The form is more nearly that of a truncated cone than represented in the figures alluded to.

The construction was found, by very thorough excavation, to be as follows: the entire surrounding slope (No. 4, fig. 1) was of hard, tough, red clay, which could not have been obtained nearer than half a mile; the cylindrical core, sixty feet in diameter, and extending down to the original surface of the ground, was composed of three horizontal layers, — the bottom layer (No. 1), ten feet thick, of rich, dark, and rather loose loam; the next (No. 2), four feet thick, of hard, beaten (or tramped) clay, so tough and hard that it was difficult to penetrate it even with a pick; and the uppermost (No. 3), of sand and surface soil between one and two feet thick. A trench was dug from opposite sides to the central core; and, when the arrangement was ascertained, this central portion was carefully explored to the original surface of the ground.

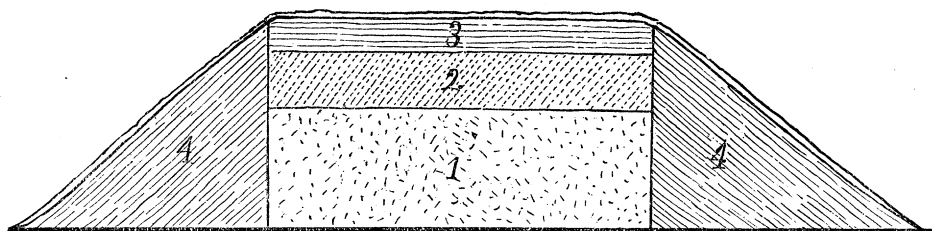


FIG. 1.

seven-tenths of an acre; the length of the roadway which winds up the southern slope is two hundred and one feet, and the width sixty-one feet. This roadway is described, in all the reports I have seen, as reaching the summit level. This is a mistake; as it stops short of the top by thirty feet slant height, or twenty feet perpendicular height. I can also state confidently that it never reached any farther up, as is apparent from a mere glance at the plan of construction. The remainder of the ascent, which is quite steep, was probably made by steps or ladders.

The mound in which the articles mentioned were found by Mr. Rogan, who excavated it on behalf of the bureau, and a vertical section of which is given in fig. 1, is the smallest of the three, and the one marked *C* in Jones's plate, and also in Col. Whittlesey's fig. 2. The measurements, as ascertained by Mr. Rogan, are as follows: average diameter at the base, a hundred and twenty feet; diameter of the level top, sixty feet; height above

Nothing was found in the layer of clay (No. 2), except a rude clay pipe, some small shell beads, a piece of mica, and a chunkee stone. The burials were all in the lower layer (No. 1), of dark, rich loam, and chiefly in stone cists or coffins of the usual box-shape, formed of stone slabs, and distributed horizontally, as shown in fig. 2, which is a plan of this lower bed.

From Mr. Rogan's field-notes I quote the following description of these graves, mode of burial, etc.: —

Grave *a*, fig. 2. — A stone sepulchre two feet and a half wide, eight feet long, and two feet deep, formed by placing steatite slabs on edge at the sides and ends, and others across the top. The bottom consisted simply of earth hardened by fire. It contained the remains of a single skeleton, lying on its back, with the head east. The frame was heavy, and about seven feet long. The head was resting on a thin copper plate, ornamented with figures of some kind; but the head was crushed and the plate injured by fallen slabs. Under the copper were the remains of a skin of some kind; and under this, coarse matting, probably of split cane. The skin and

matting were both so rotten that I could only secure them in fragments. At the left of the feet were two clay vessels, — one a water-bottle, and the other a very small vase. On the right of the feet were some mussel and sea shells; and immediately under the feet two conch-shells, *Pyrula perversa*, partially filled with small shell beads. Around each ankle was a strand of similar beads. The bones and most of the shells were so far decomposed that they could not be saved.

Grave b. — A stone sepulchre four feet and a quarter long, two feet wide, and a foot and a half deep, differing from a only in size and the fact that the bottom was covered with stone slabs. The skeleton was extended on the back, head east. On the forehead was a thin plate of copper, the only article found.

Grave c. — A stone sepulchre three feet and a half long, a foot and a third wide, and a foot and a half deep; the bottom being formed of burnt earth. Although extending east and west, as shown in fig. 2, the bones had probably been interred without regard to order, and disconnected; the head being found in the north-east corner with face to the wall, and the remaining portion of the skeleton in a promiscuous heap. Yet there is no indication of disturbance after burial, as the coffin was intact. Between some of the bones I found a thin plate of copper that had been formed by uniting and riveting together smaller sections. Some of the bones found in this grave were saved.

Grave d. — A small sepulchre, a foot and a half square by a foot deep, contained the remains of an infant, also a few small shell beads. The slabs forming the sides and bottom of this grave bore very distinct marks of fire.

Grave e. — Simply a headstone and footstone, with the skeleton of a very small child between them; head east. On the wrists were some very small shell beads. The earth on the north and south sides had been hardened in order to form the walls.

Grave f. — Stone sepulchre six feet long, three feet wide, and a foot and a third deep, with stone in the bottom. Skeleton with the head north. There was a lot of copper about the head, which, together with the skeleton, was wrapped in a skin. The head rested on a large conch-shell (*Pyrula perversa*), and this on the remains of a coarse mat. Shell beads were found around the neck, each wrist, and ankle. On the right was a small cup, and on the breast an engraved shell. The copper had preserved a portion of the hair, which I saved; portions of the skin and matting were also secured.

Immediately under b was another stone grave or coffin, three feet long, a foot and a half wide and deep, extending north and south. The head of the skeleton was toward the north, but the feet were doubled back under the frame in order to get it in the allotted space. The only things found with this skeleton were some beads around the neck.

At g the remains of a child were found, without any stones about them. Some shell beads were around the neck and wrist, and an engraved shell on the breast.

Grave h. — A stone sepulchre a foot and a half square and a foot deep, stone slabs on the four sides and top, but the bottom consisting simply of earth hardened by fire. This contained only a trace of bones, and presented indications of at least partial

cremation; as all around the slabs, outside and inside, was a solid mass of charcoal, and the earth was burned to the depth of a foot.

Grave i. — A stone sepulchre four feet and a half long, a foot and a half wide and deep, bottom earth, contained the remains of a skeleton resting on the back, head north, and feet doubled back so as to come within the coffin. On the breast was a thin plate of copper, five inches square, with a hole through the centre. Around the wrists were beads, and about the neck rather more than a quart of the same.

At j were the remains of a small child, without stone surroundings; under the head was a piece of copper, and about the neck and wrists shell beads.

These graves were not on the same level; the top of some being but two feet below the clay bed (No. 2), while others were from two to three feet lower.

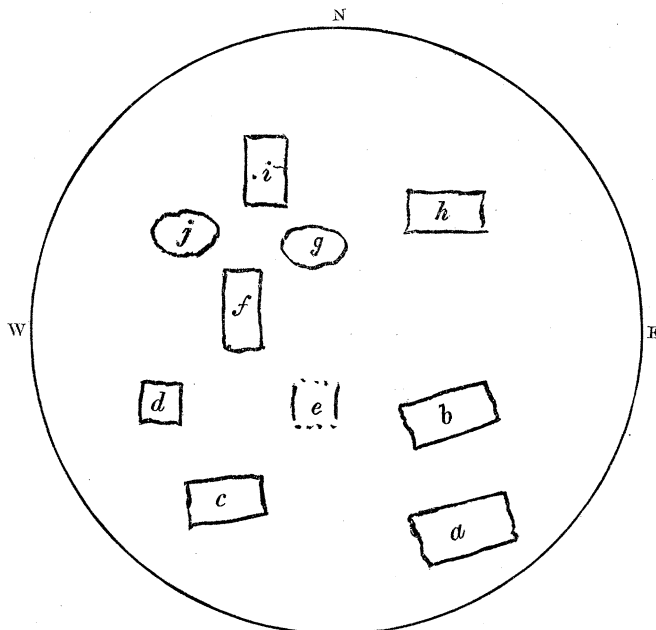


FIG. 2.

All the articles alluded to as obtained in this mound were forwarded at once to the Bureau of ethnology, and are now in the National museum. Examining them somewhat carefully since their reception, I find there are really more copper plates among them than Mr. Rogan supposed; the number and description being as follows:—

1. A human figure with wings, represented in fig. 5 of Mr. Holmes's paper, and repeated in our fig. 3. This is thirteen inches long and nine inches wide. A portion of the lower part, as shown by the figure, is wanting, probably some three or four inches. There is a break across the middle, but not sufficient to interfere with tracing out the design. A crown-piece to the head ornament is also wanting.

2. Also a human figure, shown in our fig. 4. Length, sixteen inches; width, seven inches and a half.



FIG. 3.

3. Figure of a bird, very similar to that represented in fig. 6 of Mr. Holmes's paper, but considerably larger, and varying slightly in details. This is imperfect, as part of the head, and the outer margin of the wings, are wanting. Length, thirteen inches and a half; width, seven inches and a half. This plate shows indubitable evidence of having been formed of smaller pieces welded together, as the overlapping portions can be easily traced. It has also undergone repairs: a fracture commencing on the left margin, and running irregularly half-way across the body, has been mended by placing a strip of copper along it on the under side, and riveting it to the main plate; a small piece has also been riveted to the head, and the head to the body; several other pieces are attached in the same way. The rivets are small, and the work neatly done.

4. An ornament or badge of some kind, shown in fig. 5. The two crescent-shaped pieces are entirely plain, except some slightly impressed lines on the portion connecting them with the central stem. This central stem, throughout its entire length and to the width of six-tenths of an inch, is raised, and cross-strips placed at various points along the under side, for the purpose of inserting a strip of bone; a

part of which yet remains in it, and is seen in the figure at the break immediately below the point where the oblique strips meet. The most important and interesting fact presented by this specimen is the indubitable evidence it furnishes that the workman who formed it made use of metallic tools, as the cutting in this case could not possibly have been done with any thing except a metallic implement. A single glance at it is sufficient to satisfy any one of the truth of this assertion. Length of the stem, nine inches; width across the crescents, seven inches and a half.



FIG. 4.

5. Part of an ornament similar to No. 4. These plates, especially No. 4, appear to be enlarged patterns of that seen behind the head of fig. 3.

6. An ornament or badge, shown in fig. 6, which Mr. Rogan, when he found it under the head of the skeleton in grave *a*, was inclined to

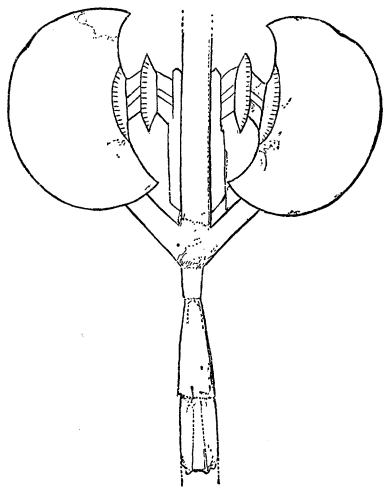


FIG. 5.

consider a crown. It is imperfect, a narrow strip across the middle and a portion of the tip being missing. As shown in the figure, it measures around the outer border nineteen inches and across the broad end three inches and a half. The six holes at the larger end, in which the remains of strings can be detected, indicate that it was, when in use, attached to some portion of the dress, or fastened on a staff.

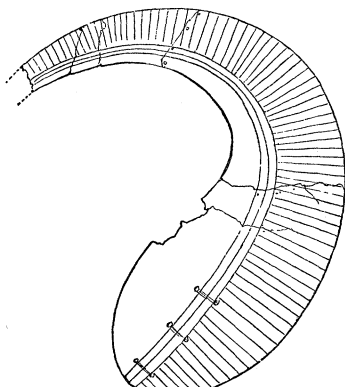


FIG. 6.

7. A fragment from the larger end of a piece similar to the preceding. Attached to this is a piece of cloth.

In addition to the foregoing, there are a number of small fragments, probably broken from

these plates; but so far I have been unable to fit them to their proper places.

An examination of what Mr. Rogan calls a skin shows beyond question that it is animal matter. The matting he speaks of appears to be made of split canes.



FIG. 7.

The shell represented in Mr. Holmes's fig. 3, reproduced in our fig. 7, is the one obtained in grave *g*. The one shown in Mr. Holmes's fig. 4, reproduced in our fig. 8, is that found in grave *f*.

I shall not attempt at present to speculate upon these singular specimens of art, further than to call attention to one or two facts which appear to bear upon their age and distribution.

First, We notice the fact alluded to by Mr. Holmes, which is apparent to every one who inspects his accurately drawn figures, that, "in all their leading features, the designs themselves are suggestive of Mexican or Central-American work." Yet a close inspection brings to light one or two features which are anomalies in Mexican or Central-American

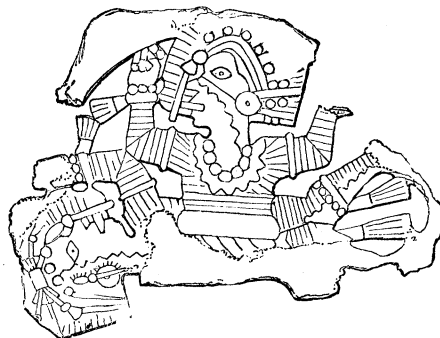


FIG. 8.

designs; as, for example, in figs. 3 and 4, where the wings are represented as *rising from the back of the shoulders*,—a fact alluded to by Mr. Holmes. Although we can find numerous figures of winged individuals in Mexican de-

signs (they are unknown in Central-American), they always carry with them the idea that the individual is partly or completely *clothed in the*

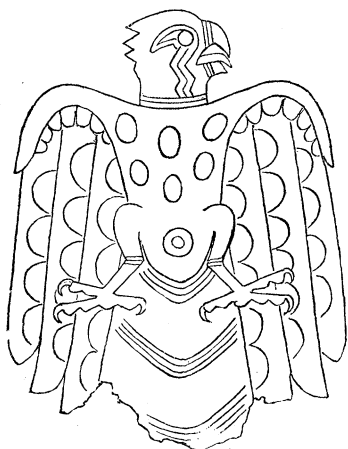


FIG. 9.

skin of the bird. This is partially carried out in our copper plate, as we see by the bird-bill over the head; the eye being that of the bird, and not of the man. But when we come to the wings, we at once see that the artist had in mind the *angel figure* with wings arising from the *back of the shoulders*, — an idea wholly foreign to Mexican art.

Another fact worthy of note, in regard to these two plates, is that there is a combination of Central-American and Mexican designs: the graceful limbs, and the ornaments of the arms,

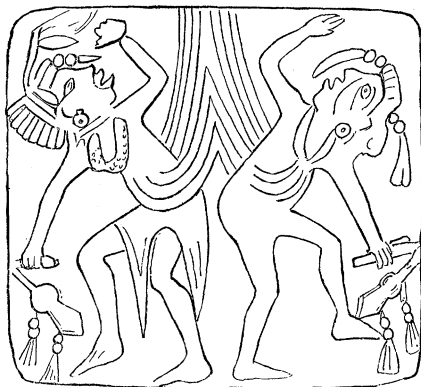


FIG. 10.

legs, waist, and top of the head, are Central American; and the rest, with the exception, possibly, of what is carried in the right hand, Mexican.

That these plates are not the work of the Indians found inhabiting the southern sections of the United States, or of their direct ancestors, I freely concede. That they were not made by an aboriginal artisan of Central America or Mexico of ante-Columbian times, I think is evident, if not from the designs themselves, from the indisputable evidence that the work was done with hard metallic tools.

Second, Plates like those of this collection have only been found, so far as I can ascertain, in northern Georgia and northern and southern Illinois. The bird figure represented in fig. 9 was obtained by Major Powell, the

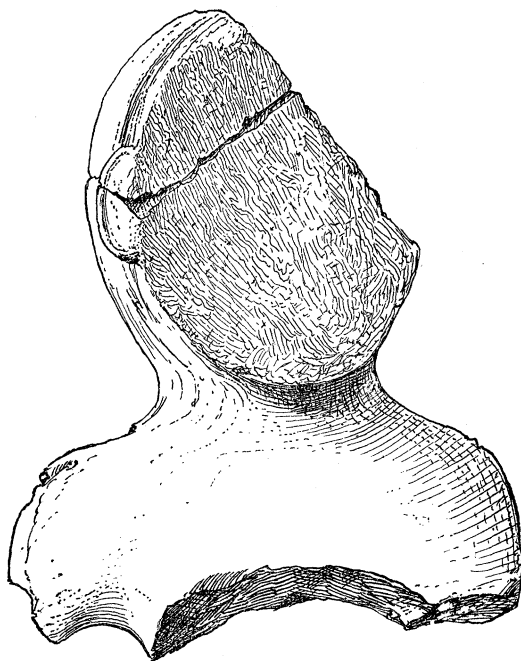


FIG. 11.

director of the U. S. geological survey, from a mound near Peoria, Ill. Another was obtained in Jackson county, Ill., by Mr. Thing, while engaged by the Bureau of ethnology, from an ordinary stone grave. From another similar grave, at the same place, he also obtained the plate represented in fig. 10. Fragments of another similar plate were obtained by Mr. Earle from a stone grave in a mound in Alexander county, Ill. All these specimens were received by the Bureau of ethnology, and are now in the National museum.

I cannot enter at present into a discussion of the questions raised by the discovery of these engraved shells; nor is it necessary that

I should do so, as Mr. Holmes has discussed somewhat fully these designs in the second annual report of the Bureau of ethnology. But I may add that these figured copper plates and engraved shells present a problem very difficult to solve, as is evident from the following facts:—

1°. A number of the designs bear too strong resemblance to those of Mexico and Central America to warrant us in supposing this similarity to be accidental. 2°. The indications of European workmanship are too evident to be overlooked. 3°. The fact that some of them were found in connection with articles of European manufacture is unquestionable. 4°. The evidence that some of the engraved shells can be traced to the Indians is well-nigh conclusive.

Mr. Rogan sank a large shaft, seventeen feet square, to the bottom of the second mound (marked *B* in Jones's plate, and also in Col. Whittlesey's figure). No burials or objects of interest were found in it, except the remains of four posts, extending four feet below the surface, placed in the form of a parallelogram, two feet one way, and six feet the other. The strata were as follows: first, a bottom layer of white sand two feet thick; next, between nine and ten feet of dark red clay; then two feet more of white sand; and, lastly, a top layer of some six or seven feet of dark sandy loam.

Mr. Rogan found in one of the small, low mounds east of the large one (those marked *FF* on Jones's plate), the fragment of a stone image. This fragment, which shows most of the form of the bust, is represented in our fig. 11. It is made of a coarse white marble: and the part shown in the figure is ten inches and three-quarters long; the length of the head, seven inches and a fifth; and width of the head, five inches and three-quarters. The face is entirely wanting, and from appearance, I judge, was broken off designedly.

CYRUS THOMAS.

A HUMAN SKULL FROM THE LOESS OF PODBABA, NEAR PRAGUE.¹

AMONG collections of bones from the diluvium of the vicinity of Prague, human skulls are often found. From the color of the earth adhering to them, however, it is evident that they come from graves of the stone and bronze age, which here frequently occur in the top layer of the loess deposit, and are filled with dark loam. I also once received a normal skull found at a great depth in a lime-kiln at Tyrolka, not far from Prague, but in such relations that the overlying strata were presumed to have obtained their present position from a slide down the steep sides of the valley.

In the winter of 1883 some workmen brought me numerous bones of the reindeer, the rhinoceros, and

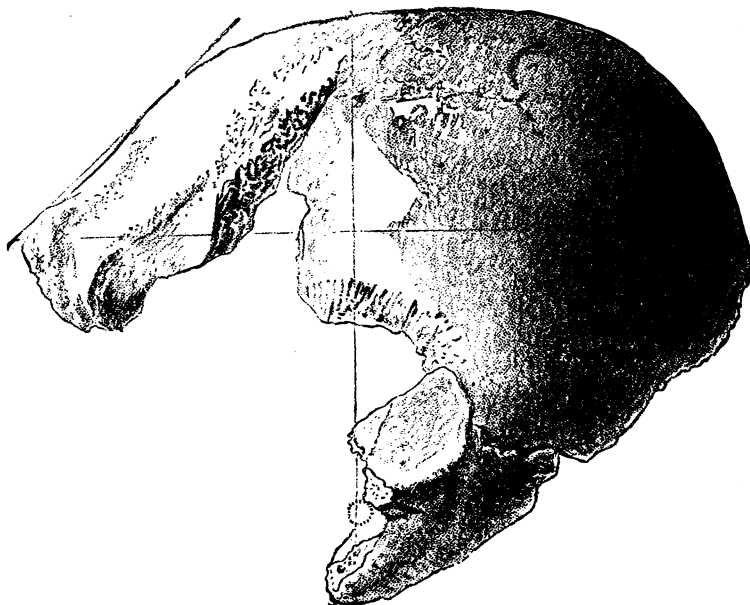


FIG. 1.—LATERAL VIEW OF HUMAN SKULL, FROM DELUVIAL CLAY NEAR PRAGUE (ONE-HALF NATURAL SIZE.)

the mammoth, from the clay behind the brewery at Podbaba, and, on the 30th of November, the remains of a human skull. After carefully putting together the newly broken parts, a skull was apparent, the remarkably depressed shape of the forehead of which must surprise every one. As this came from the same strata as the bones of ancient mammals obtained from this place, I immediately went there in order to determine more definitely the state of things. The skull was found by a workman named Hlavatý, in undisturbed brick-clay (loess) two metres thick, lying under one metre of dense loam, and at the same level at which, about a week previously, I had obtained the tusk of a mammoth.

¹ Abstract of a communication to the Bohemian society of sciences, by Dr. ANTON FRITSCH.

The skull consists of the frontal bone, the whole left parietal, a fragment of the right as well as a part of the left temporal bone, with the petrosa. The occipital bone, the face, and the base of the skull, are lacking; but freshly broken surfaces indicate that the skull was complete, and that the missing fragments are lost. On this account, measurements according to the accepted rules could not be given.

I therefore sought for lines which would permit a comparative measurement with a modern skull. I joined the point of the upper edge of the orbit with that in which the parietal bones are connected at the end of their median suture, and from it drew a line perpendicular to the lower end of the mastoid process of the petrosa (see fig. 1). I did the same, also, to a normal skull, and ascertained by this means the great difference in the shape of the forehead, and the lowness of the skull arch. A measurement made in the same way, of the slope of the forehead in a normal brachycephalic Bohemian, amounts to seventy-two degrees, while the skull from Podbaba measures fifty-six degrees. In a normal skull, the height of the crown above this horizontal line is 7.2 centimetres; in the skull from Podbaba, 5.6 centimetres. The position of the outer opening of the ear may be reconstructed with some exactness by means of the channel running diagonally across the temporal bone. A further remarkable characteristic of the skull is the very strongly developed eyebrows, which, in their



FIG. 2. — THE SAME, TOP VIEW.

inner half, are little inferior to the Neanderthal skull. A cross-section of the stoutest portion of the parietal bone shows that only the middle third is porous. The bone has nearly the same appearance as those of the diluvial mammals found in the same clay, commonly considered fossil. A few small fragments of

the bones of the extremities were obtained with the skull, but their inter-relation would be difficult to prove.



FIG. 3. — THE SAME, FRONT VIEW.

From the same clay a skeleton of a girl of the bronze age was recently brought to me, one hand still holding a bracelet, which had turned the distal end of the arm green. A few days later I obtained two nearly perfect skeletons of full-grown men from a neighboring lime-kiln. All these skeletons came from graves situated in the top layer of the loess and in the loam. All are typical dolichocephali, with beautifully arched foreheads. The bones are soft and fragile, and are at once distinguishable, on a glance, from the skull with low forehead found deep in the loess.

After repeated visits to the locality, I succeeded in determining that it was in precisely this layer, two metres below the loam, that all the mammal remains obtained at this place had been found; viz., a tusk of a mammoth seventy-five centimetres long, two skulls of *Rhinoceros tychorhinus*, reindeer, and horse. Since this is the same level from which the human skull came, it may be considered as established beyond doubt, that the mammoth, the rhinoceros, and man lived in Bohemia at the same period.

As I am no craniologist by profession, and am especially occupied with other paleontological material, I think I act agreeably to all anthropologists in sending the skull for further examination to Professor Schaafhausen. This high authority, to whom I have already sent a plaster cast, declares it very interesting, and will be prepared shortly to report on it.

PRIMITIVE COMMUNITIES.

DURING the year 1883 three books were published which were of so great importance in the early history of institutions, that it seems worth while to examine them with some care in their relation to one another, in order to determine the precise extent and value of their contribution to this study. These books are, Sir Henry Maine's 'Early law and custom,' Mr. Frederic Seebohm's 'English village community,' and Mr. D. W. Ross's 'Early history of land-holding among the Germans.' Sir Henry Maine's book, being a collection of essays of a considerable range of discussion, will be touched upon only incidentally: the other two, those of Mr. Ross and Mr. Seebohm,

being in the same general line of investigation, and arriving at essentially the same results, deserve careful study by themselves.

The principal object of these two books, so far as they are controversial in character, is to disprove the accepted theory of village communities. The existence of village communities as a feature of serfdom, they readily accept; and Mr. Ross even recognizes certain *quasi* communities of freemen, of a comparatively late date, and of subordinate importance: but the agricultural community of free peasants, purely democratic in its structure, as a regular and necessary phase in the history of Germanic society, they either deny altogether, or accept as a merely transient and unimportant phenomenon.

It may be noted here, that neither of these treatises aims to cover the entire ground of the inquiry. Mr. Seebohm's investigations are, for the most part, confined to the English people, — an intruding people, settled by conquest upon a soil to which they were foreign. Here he appears to have completely established his thesis by a series of inductions of remarkable fulness and cogency, and to have shown that the evidence before us does not warrant us in going back of the *servile* community which we know to have existed in the middle ages. But when he passes from England to the original home of the English, he contents himself with the discussion of two or three points, of considerable interest and importance, it is true, but which do not go to the bottom of the matter. Mr. Ross pursues his inquiries by a precisely opposite method. Instead of working back inductively from the present to the past, he begins with the first settlement of the Germans in their permanent homes, and traces their landed institutions step by step down to fully historical times. Like all deductive processes, his reasoning depends for its force upon our acceptance of the proposition with which he starts.

This proposition is (p. 1), that "the freemen settled neither in villages nor in towns, but apart, from one another, in isolated farmsteads." Of the evidence for this proposition, derived from chap. xvi. of the *Germania* of Tacitus, I spoke some months ago (see *Science*, No. 45), in a review of Mr. Ross's book. My object now is not to repeat what I said then, or to examine the proposition itself, but to bring it into relation with other connected branches of inquiry. Mr. Ross has given us an invaluable treatise upon early German land-holding; but landed institutions are only one of a group of institutions, and, however fundamental their importance, they cannot be fully understood, except in connection with the social organization and the political institutions of the people in question. Moreover, however fundamental the landed institutions are at the stage of civilization in which the Germans were at the time of the migrations, in the earlier stages of society they are of only secondary importance, and, indeed, only come into existence at a relatively late epoch in the life of any community.

Primitive communities stand in no relation to the land except that of occupation. Land is to them a free gift of nature, just like air; and individual own-

ership, or even permanent individual occupation, is inconceivable to them. For primitive communities, the most fundamental consideration is that of the social organization, — the structure of society: the relation to the land does not come into consideration until the people has passed through savage life and the lower stages of barbarism, and has settled down to permanent occupation and systematic agriculture. Then, upon the passage from the personal to the territorial basis of organization, the land becomes the subject of the first consequence. It is readily seen, therefore, that Mr. Ross, starting with individual property in land, leaves out of sight — as he has a right to do — all the earlier phases of landed relations, as well as the entire question of social structure. We cannot, however, fully understand the landed institutions themselves, or fully appreciate the bearing of Mr. Ross's researches, without bringing them into relation with these cognate branches of inquiry.

It will be well to diverge here for a moment to Sir Henry Maine's book, which raises a question similar to that under consideration. In chap. vii., 'Theories of primitive society,' he pronounces in favor of the 'patriarchal theory of society,' — that is, "the theory of its origin in separate families, held together by the authority and protection of the eldest valid male ascendant," — against the view presented by Morgan and McLennan, of its origin in the horde. That this was the history of society as we are in condition to trace it, especially in the Indo-European family of nations, there is no doubt; but the patriarchal family, like individual ownership of land, requires something back of it to account for its origin. It is not primitive, but must itself be the outcome of ages of gradual advancement.

The theory of the patriarchal family, as defined by Sir Henry Maine, lends itself readily to Mr. Ross's theory of landed relations. The German warrior, upon the settlement of his tribe in a new region, may be supposed to have taken a tract of land, and settled upon it with his sons and daughters, his slaves and serfs. From this beginning, the sketch of landed relations presented by Mr. Ross possesses unity and consistency. To accept it in full, however, as an exhaustive theory of the subject, we must not only agree to the interpretation of Tacitus, by which he establishes his premise, but must also bring his theory into harmony with what we know of the primitive social organization of the Germans.

It is generally agreed that the Germans, in the time of Caesar, — and these remarks apply also, in the main, to the time of Tacitus, a hundred and fifty years later, — were in what is sometimes called the seminomadic stage, but what we may, perhaps, better describe as the end of a series of migrations. There is good evidence that the intruding Germans had displaced Celts in some parts of Germany at a relatively recent date; and the great invasion of the Teutones and Cimbri at just the time of Caesar's birth, was, no doubt, a part of this general migration. This erratic movement of the Cimbri and Teutones was checked by the Romans with considerable difficulty; but an effective barrier was placed against the slow west-

ward advance of the Germans by Caesar's defeat of Ariovistus, the later campaigns of Drusus and Tiberius, and finally by the *limes*, or line of fortified posts constructed from the Rhine across to the Danube in the second century.¹ The Germans, at the time of Caesar, cultivated the ground to a certain extent, — a form of industry not inconsistent with the slow migration, occupying perhaps several centuries, by which they passed from their original home to central Europe. Once this migratory movement stopped, no longer finding scope for expansion, the Germans appear to have settled quietly within their now established boundaries, and to have passed with great rapidity into a settled condition of society, with permanent occupation of land, and a regular system of cultivating it.

At this point there is an absolute blank in our knowledge for a period of nearly three hundred years, after which time, in the weakness and disruption of the Roman empire, the Germans burst over the barriers which had held them stationary, and began a new series of migrations, of a very different type. These years, as I have said, are a complete blank, except so far as we are enabled to infer what happened during the interval, from what appears at its close. In the time of Caesar, and probably in that of Tacitus, when the *limes* was in process of construction, the Germans appear to have been still in the stage of temporary occupation of land by groups of kinsmen. What was the nature and organization of these family groups it is impossible to tell; only we have every reason to conclude that they were of far less importance in their system than in that of either Greeks, Romans, Slavs, or Celts. Like the Romans, the Germans advanced to the territorial or political stage at a relatively very early period; but while the Romans continued, even under their highly developed political system, to retain their gentile organization unimpaired, — although only as a branch of private law, — the corresponding institutions among the Germans were rapidly outgrown, and have left very slight traces in their later institutions. The larger subdivisions, which may very likely have been *gentes* in their origin, appear, in the time of Caesar and Tacitus, to have become purely territorial districts, in which, so far as our information extends, there is absolutely no feature of the family principle. They are administered, not by an hereditary or quasi-hereditary chief representing the original patriarch, as among the Slavs and Celts, but by elected magistrates (*principes*), in which no trace of the patriarchal origin is discernible; and so strongly developed are the political habits of the people, that these magistrates are elected by the entire nation in their public assembly, and assigned to the several districts.² Within these districts the family groups still continue, and receive annual assignments of land at the discretion of the magistrates. This is

in the time of Caesar. In the time of Tacitus, even these lesser family groups appear to have lost much of their original character; for he does not mention it as a feature of their constitution. When we reach the settlement of the Angles and Saxons in England, we find that the *maegth*, or legal kin, was not a precisely defined group, like the Roman *agnatio*, but was irregular and fluctuating in the highest degree.¹ The same fact, the inferior importance of the kin as compared with all the other European branches of the Aryan race, is shown distinctly in the popular literature. In the story of Burnt Njal, for example, the patriarch lives surrounded by his sons and daughters; but so far is he from possessing the Roman *patria potestas*, that he has no power even to withhold his sons from the perpetration of a gross crime.

When the Germans come under our observation again, at the time of the migrations in the fourth and fifth centuries, we find, in place of the system of shifting occupation of land, a fully developed system of individual ownership. This Mr. Ross appears to have completely proved. That the ownership was not yet complete, for the purposes of alienation and devise, does not affect the main question. It was precisely so among the ancient Romans, who possessed the most vigorous and logical conception of individual property (*dominium*) in land which any people has ever had; nevertheless, the *paterfamilias* held this property in trust, as it were, for his heirs, without power either of alienation or devise. Here comes in the importance of the distinction made by Mr. Ross between *common* and *undivided* property. The land belonged to the freeman and his heirs, not to the community, and, when divided, was divided *per stirpes*: it was therefore not common, but undivided.

The question now arises, What connection was there between the system of shifting occupation described by Caesar and Tacitus, and that of individual ownership which existed at the time of the migrations? To answer this question, we have absolutely no positive data, but may arrive at certain inferences by following deductively the tendencies at work in the earlier period, or by detecting in the later period survivals of perished institutions.

It may be said that the natural course of events would be something like this. The family group, which in the time of Caesar received an assignment of land for a year at a time, appears in the time of Tacitus to have held it for a series of years; its family character being, perhaps, at the same time modified. This is what we should naturally expect, and it is the most probable explanation of the much-disputed passage in the twenty-sixth chapter of the *Germania*. This shifting occupation, the natural accompaniment of semi-nomadic or migratory life, would cease by the force of circumstances when this form of life came to an end. The German nations being confined within definite territories, divided into permanent districts, the lesser groups would likewise become fixed. The habits of settled agriculture, the attachment to lands and residences once occupied, would very soon transform the shifting occupation

¹ For the historical importance of this *limes*, see Arnold, *Deutsche urzeit*, book i. chap. iii.

² This subject I have discussed more fully in a paper in vol. vi. of the *Transactions of the Wisconsin academy of sciences, arts, and letters*, now in press.

¹ See Professor Young's essay upon Anglo-Saxon family law.

into a permanent occupation; and with permanent occupation comes in at once the idea of ownership. Ownership of land is the outcome of a settlement in permanent homes, and the adoption of a regular system of agriculture. This ownership would be of the group, the *universi* of Tacitus, and must be common ownership in the strictest sense of the word: for the shifting occupation of individuals or households (*quos mox inter se secundum dignationem partiuntur*) would continue for a while after that of the larger groups (*agri ab universis in vices occupantur*) had ceased; and in this interval there would be real ownership, because permanency of occupation, on the part of these larger groups (*universi*), originally themselves family groups in nature, and probably still so in their prevailing character. At last the same causes which had called into existence the common ownership of the larger group would create, in turn, the individual ownership of the household. This would probably be a very rapid process. Such as it is here described, as a probable result of known causes, it is precisely what Mr. Seebohm appears to have in mind (p. 367) when he says, "It is certainly possible that during a short period . . . tribal households may have expanded into free village communities." If it took place at all, it must have been in this period of blank between the construction of the *times* and the migrations of the fifth century.

The free village community is therefore a natural and probable connecting link between what we know to have existed in the first century, and what we know to have existed in the fifth century. That it actually existed among the Germans during this epoch, we have no direct and positive evidence; but there are numerous features of the later system, in the community of cultivation, the rights of pre-emption, and the traces of occasional re-distribution, which are easiest explained as survivals of the village community. For a description of these, I need only refer to Sir Henry Maine's 'Village communities,' and similar works.

Of actual cases of village communities, indeed, in any country, it is surprising how few we have knowledge of, considering the large part they have played, of late years, in treatises upon early institutions. The villages of India are composed of independent families, joint or individual. Those of the South Slavonians are groups of house communities; the Celts never appear to have had any institution of this nature; the Greeks and Romans afford no traces of them; the German villages, as Mr. Ross has proved, were communities of independent proprietors, although bound together by ties, which seem to indicate a previous condition of collective ownership; Russia alone affords unquestionable examples of the village community of the theory. What is common to all of these, and may be fairly pronounced a universal institution of the Indo-European race, if not of the human race, in its early stages, is the family group with collective occupation of land. The nature and organization of the group, and the later history of its relation to the land, are questions into which we have not space to enter.

The obscurity and vagueness in the prevailing ideas upon the subject result from not attending to the fundamental character of the transition, in early society, from the personal structure of society (based upon the family relation) to the political organization (based upon territory). In the earlier stage we have family groups occupying a definite territory: in the later stage we may have a definite territory — the *mark* or village circumscription — occupied and owned in common by a group of proprietors. These proprietors may be the family group of the earlier stage, or they may have taken in members of different origin: in any case, the point of view has shifted, and is now territorial instead of personal. This condition of things, if it ever existed, is the free village community.

W. F. ALLEN.

TECHNICAL EDUCATION IN EUROPE.

A SECOND and important instalment of the Royal commission, appointed in England in 1881 to inquire into the subject of technical education, was published on May 16. The preliminary report presented during the session of 1882 dealt exclusively with the condition of things in France, where educational development has been most remarkable. The percentage of illiterate conscripts in 1833 was forty-seven and eight-tenths: in 1867 it had fallen to twenty-three, and in 1880 to fifteen, per cent. The law of the 16th of June, 1881, which came into operation on the 1st of January following, decreed gratuitous instruction available for the working-classes throughout an extended series of schools, commencing with the *Salles d'asile*, which are being converted into kindergarten schools, and graded upwards to the 'superior elementary schools,' in which technical instruction is given, and trades taught. The commissioners appear to have been favorably impressed with what they saw of the handicraft teaching of the Christian brethren in France, Belgium, and Ireland. The combination of manual with ordinary literary instruction imparted to very young children appears to have been first tried in 1873, at the communal school in the Rue Tournefort, with such satisfactory results that schools of the same type are being rapidly and extensively established. "Drawing, modelling, and carving are taught as part of the curriculum; and lathes, forges, and joiners' benches are as much matters of course as desks and blackboards. In the Boulevard de la Villette is the apprenticeship school, established some twelve years ago by the city of Paris, for boys who have completed the ordinary primary-school course, and to whom is given what professes to be a very thorough training in the theory and practice of numerous handicrafts; the pupils especially distinguishing themselves as pattern-makers and engine-fitters. Nearly fifty thousand pounds is said to have been expended on the establishment of this institution, and nearly three thousand pounds is required for its annual maintenance." The abolishing of the old system of apprenticeship is the main object of this institution. The most striking examples of primary schools are to be found

in the Swiss cantons. In Zurich a communal school is described the building for which cost sixty-six pounds per pupil, — five times the much-complained of London average. There are no fees, and ninety-seven and a half per cent of all the children of school age are said to attend schools of this type. The average attendance is returned as ninety-five, — a remarkable contrast to the seventy-two per cent which was the average in England and Wales a year ago; and no proposal for the reduction of school expenditure can find a hearing as an election cry in Switzerland. Without a mine, a canal, or a navigable river, Switzerland carries on extensive cotton and silk weaving, paper-making, and calico-printing works; and the report grows quite enthusiastic on the aniline-color works of Basle, an abundant supply of skilful chemists being thoroughly trained in such institutions as the Polytechnicum at Zurich, or the Bernoullianum at Basle. The report shows that the higher educational institutions are as various in the different countries as they are generous and complete in most. In the German empire there are twenty-four universities. The buildings for the Strasburg university are now nearly complete, and are to cost six hundred thousand pounds. The department of botany has had a sum of twenty thousand pounds devoted to it; that of physics, thirty thousand pounds; and that of chemistry, thirty-five thousand pounds. The votes for maintenance are similarly ample. The rivalry between the universities and the polytechnic schools is wholesome, if costly. New buildings are now being completed at Charlottenberg, in which the work of the old technical high school of Berlin will be carried on. There are many intermediate schools between the primary schools and the universities and polytechnic schools. The 'Fortbildungsschulen' of Germany are very beneficial institutions. "The work of the primary day schools is carried on in evening classes with a direct and practical bearing on the occupations upon which the pupils have entered. But in every country, and notably in France and Belgium, there are night classes provided for the instruction of the industrial classes in drawing and modelling, directly applied to decorative art, as well as in popular science and general knowledge. Then, again, there are schools still more specialized for instruction in weaving, in practical mining, in dyeing, and in designing for every conceivable kind of artistic manufacture. This teaching is often gratuitous; but, where fees are exacted, they are always small; and there is everywhere prevailing a system of bourses and scholarships by which meritorious pupils are enabled to carry on their studies. The state, the province, and the commune bear the charges in their allotted proportions." The use of museums and art-galleries, open on Sunday for the benefit of designers, is much dwelt on by the commissioners, who embody a recommendation of Sunday opening in their report.

Mr Samuelson and his colleagues travelled at their own expense, and have spared no exertion to place their facts before the public in a complete and useful manner.

THE AGE OF STEEL.

The creators of the age of steel (on Sir Henry Bessemer, Sir C. W. Siemens, Sir Joseph Whitworth, Sir John Brown, Mr. S. T. Thomas, and Mr. G. J. Snelus). By W. T. JEANS. New York, Charles Scribner's sons, 1884. 314 p. 8°.

IN this little collection of biography, the author has given a very interesting, and we may presume thoroughly authentic, account of the lives and the achievements of the great engineers who have during the past generation, 1850 to 1880, become famous as the 'creators of the age of steel.'

The list given by Mr. Jeans includes Messrs. Bessemer, Siemens, Whitworth, Brown, Thomas, and Snelus, but omits Mr. Mushet (in regard to whose claims a somewhat sharp controversy is now going on in the English periodicals), and makes no mention of two great American claimants for hardly less honor than is indisputably due to Bessemer himself, — Mr. Kelly, the contemporaneous inventor of the pneumatic process; and Mr. Holley, the great engineer, who by his wonderful ingenuity in the development of the details of the mechanical processes involved, and by his exceptional genius for designing automatic and efficient machinery, brought up the productiveness of our American establishments to double and treble that of those of European construction, and, in some cases, to several times the magnitude of output for which they were originally calculated.

The sketch of Sir Henry Bessemer is particularly full and satisfactory; and the author evidently feels unlimited admiration for the man, as well as for his work. He outlines the career of the exiled Anthony Bessemer, the father of Sir Henry, whose expulsion from France gave to Great Britain a family of whose achievements the world has learned to speak as those of its greatest benefactors. The father was no less ingenious than the son, and was famous, in his day, for his success in the arts of the gold-refiner and of type engraving and founding.

The son, now Sir Henry Bessemer, was born in England in 1813, and at a very early age exhibited his predilection for mechanics, and especially for its more artistic branches. He became a modeller, a designer, and an engraver, and invented new processes for use in the stamp-office, that were admired both for their singular ingenuity and for their efficiency. Losing the hoped-for reward for these inventions through those delays and those soulless methods characteristic of government offices,

he turned his attention to other lines of invention, producing a machine for working velvets, new type-making machinery, apparatus for making bronze powders, and other equally important and profitable devices. For many years previous to the conception of his greatest invention, the young man's mind was astonishingly prolific of valuable and remarkable devices and processes.

In 1853, when forty years of age, his attention was called to the importance of effecting improvements in the then crude forms of ordnance, and the unsatisfactory character of all ordnance metal. He devised a method of firing elongated projectiles from smooth bore guns, — a plan which had been attempted, but unsuccessfully, at intervals of every few years, from the time of probably its first and tolerably successful inventor, Robert L. Stevens, in the beginning of the century. The plan was to a certain degree satisfactory; but it brought out very strongly the evident necessity of obtaining a better metal for ordnance; and to this problem the young mechanic now addressed himself. Studying the problem in the truly philosophic manner, he saw that the end to be gained was the removal of carbon, and other impurities in the crude cast-iron, by some process that should do the work thoroughly, quickly, cheaply, and yet give a product in the form of ingot-metal. He saw that this could be done by a process of oxidation, and finally hit upon the idea of performing this operation by driving air, in finely divided streams, upward from a submerged reservoir, through the mass of molten cast-iron. This was the invention of the 'Bessemer process,' the greatest invention in the history of metallurgy. It was as simple, and apparently as obvious, a method of accomplishing the work, as can be conceived: its simplicity and obviousness are such as make it seem wonderful that it had not been done a century earlier. The story of Columbus and the egg here finds a parallel.

Some minor and accessory, yet essential, inventions were required to perfect the main invention, which delayed success some months; but they were in time perfected by the unconquerable Bessemer: and the process, after those delays which are inevitable whenever it is necessary to overthrow old methods in the introduction of new ones, became commercially successful. It was only, however, after Bessemer and his partners had built steel-works, and had shown on a full scale how far his devices were capable of yielding profit, that the iron-manufacturers and the steel-makers were

induced to accept it as the coming steel-making process.

But the Bessemer process would be of comparatively little value, except for the invention of the now universal method of recarburizing — after the first operation, that of removing the silicon and carbon, is completed — by the use of 'spiegeleisen' or of ferro-manganese. It is this detail that gave the inventor success, after months of delay, within sight, apparently, of his goal. The question of priority of discovery of this method of recarburizing is still in dispute between the friends of Bessemer and of R. F. Mushet, and may never be fully settled to the satisfaction of either. There would seem to be no doubt that both of these metallurgists were working in this direction at the same time, and that both hit upon it at very nearly the same date. The fact, however, that Bessemer has never paid royalties to Mushet, is perhaps the best evidence, at least, of the legal status of the case.¹ No one will, however, question that Mushet was on this track when Bessemer was working at the same point; and it is most probable that he found the solution of the problem at about the same time with the more fortunate inventor. Bessemer has himself frankly acknowledged the importance of Mushet's share in the invention claimed for him. The fact seems to be, that Mushet used spiegeleisen, or ferro-manganese, while Bessemer was still trying to use the oxide of manganese.

This, in brief, is the history of the invention of the Bessemer process of making steel, — an invention which has, in the short space of a quarter of a century, completely revolutionized some of the greatest of human industries; which has reduced enormously the cost of making the 'mild' steels which are now, consequently, displacing iron in every department of manufactures; and which bids fair in a very few years, even if it cannot be said to be an accomplished fact to-day, to convert the iron-manufactures of the world into steel-manufactures, and which has thus inaugurated the 'age of steel.'

To make the story of the Bessemer process complete, the author of this little history should have told of the advances made in the United States, where the work done by Bessemer in Great Britain was first copied, then improved upon, till to-day the capacity for production has been enormously increased, works originally built for a production of thirty thousand tons per year having carried the figure up to from

¹ Mushet patented the invention, but three years later allowed the patent to lapse by non-payment of the stamp-tax.

a hundred and twenty-five thousand to a hundred and forty thousand tons. This wonderful gain has been entirely due to American genius, and principally to the splendid engineering of the late A. L. Holley, who told his friend Thomas, the inventor of the 'basic process' (who, when visiting the steel-works at Troy, looked for an ingot-mould on which to seat himself after a fatiguing tour of the establishment), that, if he wished to find an ingot-mould cool enough to sit upon, he must go back to England for it.

A sketch of Sir William Siemens follows that of Sir Henry Bessemer, and a very good account is given of the so-called Siemens process of making steel. For a short outline of the life of this wonderfully versatile inventor and engineer, the reader may turn to the columns of *Science* for Jan. 11; but he will find a more detailed story of his life in the *Creators of the age of steel*.

The Siemens process of steel-making differs from the Bessemer process, of which it is in some sense a rival, but with which it is more strictly a coadjutor, in being a slow and gradual operation, conducted upon the hearth of a reverberatory furnace, — an 'open-hearth' furnace, as it is often called, — instead of being a process of rapid reduction in a closed vessel, inaccessible to the operator at any time during the period of change. This slowness of transition from the condition of cast to that of wrought iron, and the perfect accessibility permitted by the use of the open-hearth furnace, afford the workman an opportunity to watch the process of evolution of carbon, and to check it, if he desires, at any stage; to increase or diminish the proportions of any element, as he may find it necessary; and thus to obtain with certainty precisely the quality that he seeks. In the Bessemer process, the right proportions must be hit upon at the right instant, or the error permanently injures the product, and cannot be rectified. In the Siemens process, if the metal is not right when ready to tap off, the operator can readjust the proportions of carbon or of manganese until he finds, by test of samples taken from the furnace, that it is precisely as he wishes it; and he can then cast it into ingots with a positive certainty that he will obtain a marketable product. In this process, too, the refuse scrap, the rail-ends, and other waste from the Bessemer converter, can be worked up; and by it a great market for scrap wrought-iron is made.

A long and sometimes sharp controversy has arisen between the friends of the two great inventors, and especially between the friends

of Siemens and of Martin, who introduced this process in France, as to the priority and the relative merits of the inventions. The true facts of this case are probably correctly given by a committee of the Styrian metallurgical association, who voted that the principle of making cast-steel on the hearth of a reverberatory furnace was known at the beginning of the century, and that it was successfully practised in France in 1860; that Sir William Siemens invented the process of making steel in the Siemens regenerative furnace; that Martin discovered the proper mixtures for the commercial grades of steel; that the processes devised by the latter have been now superseded, and are of no present use. There is and can be no rivalry between the Bessemer and the Siemens processes, or their inventors. They occupy entirely different fields of production; and each is peculiarly adapted to making a special kind of steel, and to working up materials such as the other is least fitted to handle. Each has its place in our industrial system, and each is of direct and substantial value to the other. The Bessemer process will probably make the bulk of our steel rails, and the Siemens process will probably supply us with the best of boiler-plate, for an indefinite period of time. We shall always find a field open to both, and shall always see each taking its own place, and filling it in a manner that the other cannot imitate.

The original Siemens process was one in which the carbon was removed from cast-iron, partly by dilution with wrought-iron scrap-metal, and partly by oxidation in the flame of the reverberatory furnace of Siemens, and also, perhaps, to some extent by 'dissociation.' This method of making 'mild steel' involved the use of a large quantity of scrap, and although at first a very economical process, and continuing to be economical so long as scrap-iron flooded the market, as it did at the first, became uneconomical, comparatively, as the price of wrought-iron scrap advanced. Siemens then introduced his so-called 'ore process,' in which the reduction of the carbon was effected by the use of the ores of iron. The process as now usually conducted, under the direction of the agents of the inventor, is a mixed ore and scrap process.

The peculiarity of the product of the Siemens process is the wonderful uniformity, toughness, and purity of the metal. The most stringent demands of the engineer are readily met by the open-hearth steel-maker; and the most delicate shades of quality are obtained with an ease and accuracy that are approached by

no other known methods of making mild steels in large quantities. This is the only kind of steel in general use for boiler-plate, for bridge-work, or for general construction. The largest and finest steamships in the world are now made of this material, and their machinery is gradually absorbing a larger and larger proportion of the same kind of metal; and the time is probably not far distant when it will have completely displaced iron for all ordinary purposes of engineering construction, — as completely as has Bessemer steel displaced its rival in the manufacture of rails.

The great bridge over the Firth of Forth, with its two spans of seventeen hundred feet each, is to take forty-two thousand tons of Siemens steel. The one firm of Elder & Co. of Glasgow, the pioneers in the introduction of the marine compound engine and of steel ships, uses some twenty thousand tons of this steel per annum. In the ship-building trade, over two hundred and sixty thousand tons are now used each year.

There are now over a hundred and fifty open-hearth furnaces in operation in Great Britain alone, exclusively for the manufacture of the Siemens steel. It has been found possible to obtain temperatures sufficiently high to remove phosphorus, that bane of the steel-maker; and now moderately phosphuretted ores are worked for steel. The scrap-iron used is to a considerable extent obtained from the Bessemer works, which supply rail-ends and other waste.

Space does not permit more than a mention of the other minor, but nevertheless great, 'creators of the age of steel.' Sir Joseph Whitworth has, by a system of compression of the molten and solidifying ingot, given us a steel so perfectly sound and free from 'blow-holes' that it may be used for a thousand purposes for which ordinary steel is entirely unfitted. This steel is made by the ordinary processes, and, when poured into the ingot, is immediately placed under the plunger of a very powerful hydraulic press, and there subjected to a pressure of a thousand or two thousand tons; under which enormous load every pore is closed up, and the steel solidifies in a compact mass of such fineness of structure, that no microscope, and no physical or mechanical test, can detect the slightest defect in homogeneity. Its strength and its ductility are such that the inventor tests the ordnance which he makes of this metal by securing the shot in the gun so that it cannot be driven out; and then, firing the charge behind it, the whole mass of gas resulting from the combustion blows out at

the 'vent' without injury to the gun. No such test was ever dreamed of by any ordnance officer, or attempted with any other kind of ordnance metal.

Sir John Brown, the proprietor of the great iron and steel works at Sheffield, famous for the magnitude of the armor-plates often made there, was the first manufacturer in Great Britain to countenance Bessemer in his endeavor to make a new steel, and was the first to put up a Bessemer converter, after the early experiments of the inventor had indicated a probable success. The armor-plating of ships — an invention of our countryman, Robert L. Stevens of Hoboken — was adopted in England during the Crimean war, at about the time that the Emperor Napoleon made the first attempt to make armored vessels of service in attacking the forts at Sevastopol. Sir John Brown was one of the first of the British iron manufacturers to fit up works for the purpose of making heavy plate. He soon added Bessemer works to his establishment, and produced steel for the general market. His armor-plate is now made as a 'compound' plate, consisting of an iron backing, with a facing of steel, — a combination of which more is expected than from the simple construction. The magnitude of the works may be imagined from the fact that there are in use a hundred and sixty steam-boilers, supplying steam to the amount of eleven thousand or twelve thousand horse-power.

Other great promoters of the revolution now in progress are Messrs. Gilchrist and Thomas and Snelus: they have done much toward the reduction of the cost of making steel by the modern processes, by making it possible to use the cheap phosphuretted ores which had previously been unavailable. The new method of operation of the Bessemer process, which has effected this change, and which, as Mr. Carnegie says, has "done more for England's greatness than all her kings and queens and aristocracy together," consists simply in the lining of the converter with materials having a basic reaction, and in the introduction of similar material with the charge. Lime is the base found best adapted to the purpose; and its use has, after long experiment and the expenditure of much time and money, been made practicable by Messrs. Thomas and Gilchrist, and Mr. Snelus. At extremely high temperatures, and in the presence of lime, phosphorus will pass from the molten iron in the converter into the lime with which it meets in the lining of the vessel, and which is added before the blow; and the steel is thus freed from its most persistent and

dangerous impurity. Mr. Snelus seems to have been the first to work out this problem, and it was then perfected by the other inventors mentioned. The success of the process is to a considerable extent dependent upon the mechanical details of the plant and of its operation, — details perfected, in part, by the late Mr. A. L. Holley, one of whose latest inventions was a form of rapidly removable converter especially adapted to this modification of the older process. This new method has not been introduced as rapidly outside of Great Britain as in that country, where the scarcity of pure ores renders it of very great importance. In the United States the abundance of ores comparatively free from phosphorus renders the steel-maker to a great extent independent of the 'basic process.' All of the larger makers now have their own mines of good 'Bessemer ores,' and do not feel much interest in this latest of the great inventions of the opening age of steel.

The 'creators of the age of steel' have rendered inestimable service to mankind, and all mankind will be interested in reading the story told by Mr. Jeans. R. H. THURSTON.

THE GUATEMALTEC LANGUAGES.

Zur ethnographie der republik Guatemala. Von OTTO STOLL. Zürich, Orell Füssli & Co., 1884. 9+180 p., map. 8°.

A grammar of the Cakchiquel language of Guatemala. Translated by D. G. BRINTON. Philadelphia, McCalla and Staveland, 1884. 72 p., map. 8°.

To suppose that dialects of the Maya family are the only languages spoken by the Indians of this extensive Central-American republic would be at variance with existing facts, although they cover, indeed, the largest part of its area. The present tribes speaking allophylic languages (that is, languages belonging to other families) are the Pipil Indians, speaking an Aztec tongue, and now found in two districts only (near Escuintla, Salamá, etc.); the Pupu-luca Indians, on the border of San Salvador, belonging to the Mije stock; and the Caribs, at the mouth of Rio Dulce and in the adjacent territory of Honduras, who still speak the language of the Lesser Antilles. Otto Stoll, who, during a five-years' stay in the mountainous parts of Guatemala, has made extensive linguistic and ethnographic studies of the aborigines, has established the above classification, and also mentions the former (if not present) existence of two other dialects which may possibly form linguistic families for themselves,

— the Sinca on the southern coast, and the Alaguilac on Middle Motagua River, both from the historian Juarros.¹ The first three of the above languages are illustrated by vocabularies and linguistic comparisons with cognate dialects.

Of sixteen Maya dialects, the learned investigator offers a useful and complete vocabulary extending over three hundred terms. Subjoined to these are short texts, conversations in Indian, historic and ethnographic notices from the conquest down to our times, and an elaborate bibliography. To judge from their lexical and grammatic character, the dialects have evolved, according to Stoll (pp. 173-175), in the following historic order from the parent language:—

1. *Huastec* forms the most archaic group, now separated from all the others by its northern location.

2. *Maya*, with its subdialects of Peten and Lacandon.

The following groups (3-6) have detached themselves from the Maya of Yucatan, and their forms are of a much less archaic type:—

3. *Tzentel* group, embracing Chontal of Tabasco, Tzentel proper, Tzotzil, Chañabal, Chol,—all in southern Mexico; Mopan in northern Guatemala.

4. *Poconchi* group, embracing Qu'ekchi, Poconchi, Pocomam, Chorti, in central and eastern Guatemala.

5. *Qu'iché* group, comprehending Qu'iché, Uspantec (dialect discovered by Stoll), Cakchiquel (the dialect studied more especially by the author), Tz'utujil,—all in south-western Guatemala.

6. *Mam* group, comprehending Ixil, Mam, Aguacatec, in the western sections of the republic.

The third group constitutes a much younger branch of the Maya of Yucatan than the fourth, fifth, and sixth groups.

The Cakchiquel language is a Maya dialect, spoken on the Upper and Middle Motagua River, and around Guatemala, the capital of the republic of the same name. It was therefore called also 'lengua metropolitana' and 'lengua guatemalteca.' By request of the American philosophical society of Philadelphia, Dr. Brinton has just translated and published in its proceedings, and also in a handy, separate edition quoted above, a Spanish grammar of that language, dated 1692, and composed by an unknown author. To render the exposition of the language, which is extremely harsh of pro-

¹ Sinca is declared to be a Mixtec language by Alphonse L. Pinart.

nunciation, more complete, Brinton has added extracts from two manuscript grammars of his own library, — that of the Dominican Benito de Villacañas, who died in 1610; and that of Fray Estevan Torresano, composed shortly after 1753. Cakchiquel possesses a rich literature,

consisting of theological and some semi-historical works of native writers, of which but little has ever been printed. A map facing the titlepage points out the location of the principal tribes.

INTELLIGENCE FROM AMERICAN SCIENTIFIC STATIONS.

GOVERNMENT ORGANIZATIONS.

U. S. geological survey.

Publications. — Although advance copies of the third annual report of the survey were issued some time ago, it was incomplete as regards the illustrations. The complete report, bound, has now been received at the office, and will soon be distributed. — The fourth annual report has been issued, although it is not yet ready for distribution. It contains five hundred and five pages (i.-xxxii., 1-473), and is illustrated with eighty-five plates and fifteen figures. The report of the director presents a *résumé* of the operations of the survey for the fiscal year ending June 30, 1883; and the administrative reports following give a more detailed account of the work. The latter are by Messrs. Henry Gannett, Arnold Hague, G. K. Gilbert, C. E. Dutton, T. C. Chamberlin, R. D. Irving, S. F. Emmons, G. F. Becker, O. C. Marsh, C. A. White, C. D. Walcott, L. C. Johnson, L. F. Ward, Carl Barus, and Albert Williams, jun.

The accompanying papers are by Capt. C. E. Dutton, Mr. Joseph S. Curtis, Mr. Albert Williams, jun., Dr. C. A. White, and Mr. Israel C. Russell.

Capt. Dutton's paper is on Hawaiian volcanoes, and consists of thirteen chapters, covering a hundred and forty pages, in which the geography of the islands, and their volcanic phenomena, are described. The paper is illustrated with twenty-nine plates and three figures. The paper by Mr. Joseph S. Curtis is entitled "Abstract of a report on the mining geology of the Eureka district, Nevada." It occupies twenty-eight pages. A general outline of the district is given. The structure of 'Prospect Mountain' and of Ruby Hill are detailed; and the occurrence and source of the ore, and the future prospect of Ruby Hill, are considered. Three plates present a horizontal section and two vertical cross-sections. Mr. Albert Williams, in fifteen pages, treats of popular fallacies regarding precious-metal ore-deposits. 'A review of the fossil Ostreidae of North America, and a comparison of the fossil with the living forms,' by Dr. Charles A. White, follows Mr. Williams's paper. There are two appendices to Dr. White's paper: viz., 'North-American tertiary Ostreidae,' by Professor Angelo Heilprin; and 'A sketch of the life-history of the oyster,' by John A. Ryder. The whole paper, including the plate explanations, occupies a hundred and fifty-two pages, in which there are forty-nine full-page plates. 'A geological reconnaissance in southern Oregon,' by Israel C. Russell, a paper of thirty pages,

with three plates and ten figures, and the index of nine pages, complete the volume.

Bulletin No. 3, 'On the fossil faunas of the upper Devonian along the meridian of 76° 30' from Tompkins county, N.Y., to Bradford county, Penn.,' by Henry S. Williams, was issued in May. It contains thirty-six pages, four of which are devoted to the index, and is the first of a series of articles on the comparative paleontology of the Devonian and carboniferous faunas. The price of this bulletin is five cents.

Bulletin No. 4, 'On mesozoic fossils,' by C. A. White, is all in type, and will soon be issued. The total number of pages, including the explanations of plates, is a hundred and twenty-four. There are three papers, as follows: "Description of certain aberrant forms of the Chamidae from the cretaceous rocks of Texas;" "On a small collection of mesozoic fossils collected in Alaska by Mr. W. H. Dall;" and "On the nautiloid genus *Enclimatoceras* Hyatt, and a description of the type species." There are nine woodcut plates.

Bulletin No. 5 is by Mr. Henry Gannett, chief geographer of the survey, and is almost ready to be issued. It contains three hundred and twenty-six pages, and is called 'A dictionary of altitudes in the United States.' Mr. Gannett began the compilation of measurements of altitudes when connected with the Geological and geographical survey of the territories; and three different editions of the results were published by that organization, the last bearing the date of 1877. They related principally to the country west of the Mississippi, while the present work embraces the whole country. The elevations are arranged alphabetically under the states and territories.

Bulletin No. 6, 'Elevations in Canada,' by J. W. Spencer, is in press, and supplements bulletin No. 5.

Bulletin No. 7 is also being rapidly put into type. It is entitled "Mapoteca geologica Americana: a catalogue of geological maps of America (north and south), 1752-1881, in geographic and chronologic order," by Jules Marcou and John Belknap Marcou. This catalogue is modelled on 'Mapoteca Colombiana,' by Uricoechea of Bogota, which was published in London in 1860, and is now out of print, and rare. Besides a list of some thirty numbers relating to maps on the geology of America, in Cotta's 'Geognostische karten unseres jahrhunderts,' published at Freiberg in 1850, the only list of geological maps of America is the 'List of general geological maps relating to North America,' in the 'Geology of North America,'

by Jules Marcou (p. 122), published at Zurich in 1858. When it is remembered how the publication of American geological maps has increased in the past twenty-five years, the importance of this catalogue will be appreciated.

Bulletin No. 8, 'On enlargements of mineral fragments in certain rocks,' by Roland Duer Irving, is also in press. It will be illustrated with one wood-cut plate, five chromolithograph plates, and four woodcuts.

Bulletin No. 7 begins the second volume. A number of other bulletins are in course of preparation, and will soon be sent to the printer. — Monograph No. vii., 'Silver-lead deposits of Eureka, Nev.,' by Joseph Story Curtis, is all in type with the exception of the index. It has a hundred and ninety-three pages, and will be illustrated with sixteen plates and ten figures. — Monograph No. viii., 'Paleontology of the Eureka district,' by Charles Doolittle Walcott, is also in press, and is being rapidly put into type.

RECENT PROCEEDINGS OF SCIENTIFIC SOCIETIES.

Society of arts, Massachusetts institute of technology.

May 22. — A paper by Mr. J. M. Batchelder was read by the secretary on the electro-deposition of iridium on engraved copper plates. A process had been used by Mr. Batchelder over twenty years ago; but it did not seem to have become known, and was presented as comparatively new. The solution was prepared by fusing iridium and osmium with three times their weight of nitrate of potassium for about one hour at a bright-red heat. A fused mass was broken into small pieces, and treated with nitric acid, in a glass retort with a condenser. The osmium was separated out, and the iridium which remained was treated with chlorhydric acid, after removing the nitrate of potassium by crystallization. The solution contained about one-eighth of an ounce of iridium to a gallon of water, to which about one-quarter pound of sulphuric acid should be added. The plate is to be immersed, and connected with the battery, as usual, and, when removed, will be found coated with iridium, closely resembling the common steel plates. Such plates, coated with iridium, were very durable, and possessed many other advantages. A plate was shown which had been exposed twenty-seven years without protection; and its surface was still brilliant and uninjured. It is more easily wiped than a copper plate, the surface being, in this particular, about the same as a steel plate. — Mr. S. H. Woodbridge read a paper on the heating and ventilation of the new Institute building, and the special principles involved. The building had not been planned with special reference to any accepted system of ventilation, and only the circumstance of hollow walls rendered the introduction of such a system possible. Some of the more prominent features of the heating and ventilation system adopted are: the reversal of the ordinary custom of subordinating ventilation to economy in heating; basing the quantity of air required on determined requirements rather than on cubic capacity simply; the use of large areas of air-passages, and low velocities; making the outlet areas smaller than the inlet areas, and some peculiar features of the flues; heating by large air volumes at low temperatures instead of by small volumes at high temperatures; some modifications in the construction of the fan, increasing the efficiency; the method of control-

ling the temperatures of the coils; the method of determining the rate of condensation, and the daily aggregate condensation as a means of critical study, and of determining the cost of the heating and ventilation; and placing the ventilation and the temperature of each room under control of the engineer. The building measures about 150 by 90 feet, is 75 feet high, and contains some forty rooms, from 3,000 to 60,000 cubic feet in capacity. In determining the requisite air-supply, regard was had to the maximum number of occupants, and the character of their work. Ordinary lecture-rooms receive 1,500 cubic feet per hour for each person; physical laboratories, where some gas-flames are used, get 2,000; ordinary chemical laboratories, 3,000; the organic chemical laboratory, 4,000; and libraries, 2,000. The total capacity of the rooms is about 741,000 cubic feet, and the mean total air-supply about 3,535,000 cubic feet per hour, corresponding, with a uniform distribution, to a change of the entire air every twelve minutes. In the chemical laboratories, however, the air is changed every six or seven minutes. There are 79 flues, three feet by one foot, with a total area of about 230 square feet; and nearly one-half of these had to be located in the outside walls, notwithstanding the objections to such an arrangement. The finish of the flues is rough brick. Each inlet flue connects with but a single room, and the inlet is at about the middle of the height. The outlets are at the top and bottom of the room; the former being used only in hot weather, while the latter are always open. There are three valves or dampers on the outlet flue, — one at the top, a check-valve at the bottom to prevent a reversal of the draught, and one at the top outlet of the room. The inlet flues also have three dampers. The flues terminate in a sub-basement four feet high, under the whole building, with a concrete floor. The air enters through large windows, and, after passing through the main coil, passes through the fan into the fan room, open on three sides, to the sub-basement. The fan is twelve feet in diameter, with twelve floats, and has a free delivery over its entire circumference. The power it requires is very small. Calculation showed that the cost of heating the new building would be much greater than that of heating the old, on account of thinner walls, and other sources of loss, besides the greater quantity of air supplied. The

matter of the heating had been put into the hands of Mr. F. Tudor. The main coil heats the air to 50° or 60° C., and a supplementary coil at the foot of each flue heats it as much higher as required. As the steam main is below the boiler level, and the return below the tank for condensed water, the arrangement of these coils was quite difficult. Mr. Tudor's fractional valve is applied to each coil, and so adjusted as to just fill the coil with steam; only the condensed water escaping at the lower end, and draining into a tank, from which it is raised by a Davidson pump. The boilers and engines are all in another building, some hundred and fifty feet away. The Davidson pump serves as a water-meter to register the quantity of water condensed in the coils. For this purpose a cylinder around which a piece of paper is wound is revolved by clock-work, and a pencil so connected with the pump piston that it is gradually moved in the direction of the axis of the cylinder by the action of the pump. The length of stroke and size of cylinder being known, an automatic record is thus obtained, showing the quantity of water condensed. It also affords a means of studying many other points, as it shows the time of letting on steam and shutting it off, of starting and stopping the fan, of opening the windows, etc. From the quantity of water condensed, the amount of coal which should be consumed in heating and ventilating the building may be calculated. With the aid of this automatic apparatus, Mr. Woodbridge had studied the matter of cost, and had discovered a considerable waste, though he had not yet been able to arrive at its cause. The results of the system are fully as satisfactory as were anticipated. Professor Nichols has studied the chemical composition of the air, and has found in the case of one room, after it had been fully occupied for one hour by eighty or ninety students, the following proportions of carbonic acid expressed in parts in 10,000, — Feb. 9, 4.3; March 5, 6.1; March 11, 4.5, — thus showing practically no contamination. In regard to moisture, Mr. Woodbridge thought a relative humidity of 40% at a temperature of 65° was sufficient, as with a low relative humidity it is much easier to keep the air sweet. As a whole, the work is highly satisfactory, not because perfect, but because in so many respects it meets the wants it undertook to satisfy.

New-York microscopical society.

May 2. — Mr. Charles H. Denison, in a paper on the gold sands of California, said that the coast of California from its northern to its southern boundary, for a length of nearly seven hundred miles, is strewn with magnetic iron sand, or comminuted magnetite, carrying gold and some other metals. He described the discovery of gold in these sands at Gold Bluff, where the indications are, that the spot was once the mouth of an immense river, now extinct. The process of mining for gold among these sands was described; but this process, said Mr. Denison, has not proved profitable. On the Klamath River the gold is associated with the same sand, and with platinum and iridosmene; while, on the great San Joaquin River, zircons and stream cinnabar are its additional associates. He

mentioned, that, while the black sand is water-worn, the quartz is sharp and splintery, as if never subjected to the action of water. Nevertheless, beneath Table Mountain, where it was satisfactorily proved that it had been deposited by water, the gravel had the same sharp features.

NOTES AND NEWS.

IN order to allow an interchange of courtesies between the British and American associations, and enable the members of the two associations to attend both meetings, the meeting of the American association for the advancement of science, this year, will take place at a later date than usual.

The council of the British association has invited the fellows of the American association to join in the meeting at Montreal on the footing of honorary members; and the American association and the local committee of Philadelphia have invited the members of the British association, with their near relatives who may be with them, to take part in the Philadelphia meeting. Invitations have been sent to the leading scientific societies abroad, inviting them to send delegates to the Philadelphia meeting. The probabilities, therefore, are, that the Philadelphia meeting will be largely international in its character; and it is likely that steps will be taken to form an international scientific association. At the same time with the association meeting, the International electrical exhibition will be taking place in Philadelphia, and probably at the close of the week an electrical congress will be held. Other bodies will also be in session during the week, among them the Pennsylvania state agricultural society and the American institute of mining-engineers.

The local committee are actively engaged in perfecting their arrangements for the accommodation of the large number of persons which the unusual circumstances will call to Philadelphia; and, while the contemplated arrangements provide for two thousand members of the association, it is earnestly requested by the committee, that they be notified as early as possible of the intention of members and their families to be present. All members who intend to be at Philadelphia should therefore notify the local secretaries at an early day, and at the same time give their addresses where the 'Local circular' will reach them, if they are to be absent from their permanent homes during the summer. Definite information in relation to lodgings and transportation will be given in the 'Local circular,' with much other important information.

A series of receptions will be offered the association and its guests, including one at the Academy of music after the president's address, a reception at the Academy of fine arts, a garden party at Haverford college, and a microscopical exhibition at the Academy of natural sciences. The botanical section of the Academy of natural sciences will hold at the academy a special meeting for botanists. There will also be visits to the International electrical exhibition, the

Zoölogical gardens, Fairmount park, Independence hall, and other places of interest; and the various institutions in the city will welcome the association to their halls. During the meeting, free excursions will be offered, to the seashore, the anthracite-coal regions, and other places of interest, and possibly limited excursions to more distant points after the meeting. Special botanical and geological excursions will also be made.

The local committee are now preparing a map and guide-book for the use of members. The association post-office will be established in the Academy of music, under charge of Gen. Huidekoper, postmaster of Philadelphia; and letters and packages bearing the letters A.A.A.S. will be delivered there. Special free telegraphic facilities for personal messages have been secured, including the use of the transatlantic cable for the benefit of foreign guests. The transportation of specimens, apparatus, etc., will be attended to by the local committee, who will give particulars on receiving applications through the local secretaries. Every possible care will be taken of objects sent for exhibition or use during the meeting, and a suitable hall will be provided for their exhibition. It is hoped that members having specimens or apparatus of particular interest will exhibit them at the meeting.

The meeting will be called to order, in general session, at ten o'clock on Thursday morning, Sept. 4, in the Academy of music, by President C. A. Young of Princeton, who will resign the chair to the president-elect, Prof. J. P. Lesley of Philadelphia. After the adjournment of the general session, the sections will organize in their respective halls. General sessions and sections will be held on Friday. The vice-presidents of the sections will probably give their addresses during the day; and in the evening President Young will deliver his address at the Academy of music, after which there will be a reception tendered to the members of the association and their invited guests by the local committee and citizens of Philadelphia. Saturday will probably be given up to excursions and receptions. The general programme for the rest of the meeting will be similar to that at previous meetings.

The headquarters of the association will be at the Academy of music, which is on Broad street, in the centre of the city, very near the station of the Pennsylvania railroad and several large hotels. The sections will be amply accommodated in other halls in the immediate vicinity.

The offices of the permanent secretary and local committee, the association post-office, etc., will be at the Academy of music after Sept. 1: previous to that they will be at the Academy of natural sciences. The permanent secretary will establish his office in Philadelphia on Aug. 22.

The officers of several of the sections are arranging for special topics of discussion for the different days of the meeting. A committee of section D has already sent out a special circular. The vice-president of section E wishes it to be known that several papers have been already promised upon the subject of the crystalline rocks, which will probably form a

special topic for discussion by geologists; and that it is proposed to assign particular days to prominent subjects in geology, a large number of papers being expected. The officers of the sections are ready to receive suggestions from members; and any special plans for the advancement of the work of the sections will be made known on application.

—The annual meeting of the society for the promotion of agricultural science will be held in Philadelphia during the meeting of the American association.

—The first mail from Kadiak Island received this season has arrived at San Francisco, bringing dates to May 2. According to the correspondent of the *Bulletin*, the account of the eruption of the volcano on Augustine Island, Cook's Inlet, sent by the last advices of 1883, was much exaggerated. The island "was not split in two, and no new island was formed; but the west side of the summit has fallen in, forming a new crater, while the whole island has risen to such an extent as to fill up the only bay or boat harbor, and to extend the reefs, or sea-otter rocks, running out from the island in various directions." The hunting-party feared to be lost has arrived safely in Kadiak. No tidal waves were observed on the west shore of Cook's Inlet or on Kadiak Island. The winter had been very mild, the mercury not having fallen below 10° F.; and spring began in March, wild-flowers being in bloom in the latter part of April.

—We had occasion to review in *Science*, some time ago, the cardinal characteristics of the scientific work of the leading nations considered as a whole; and the fact was noted that German ideas have set a common standard in scientific research, which is accepted in most European countries. No English-speaking person, interested in the history or progress of investigation, nowadays would think himself competent to work in any scientific field without a pretty thorough first-hand knowledge of what had been previously written on the subject in at least two or three foreign languages, in particular the German. It is perhaps not too strong a thing to say, that no school in this country has pursued a better method of study, or done more good in the direction of assisting the learner to acquire a really useful knowledge of German and French, than the Summer school of languages, which has been held in the halls of Amherst college for a number of years past. We learn that the school will be continued this year under the general direction of Professor Montague of the department of modern languages in that college; that the department of German instruction will be in charge of Professor Heness, principal of the school of modern languages at New Haven, and Professor Zuellig, late of Boston; and that the incentives to and the facilities for acquiring this language at the coming session of the school are expected to be of a high order. The department of French will be in charge of Professor Bernard, late of L'École Albert-le-Grand, Paris; and a department of Latin and Greek will be conducted this year, as formerly, with Professor Shumway of Rutgers college as principal. As is well known, the

instruction at the Summer school of languages is based on what is popularly called the natural or inductive method, only modified according to the genius and individuality of each teacher. Only the language to be learned is used as the medium of communication; and the aim is to so interest the learner in the study, that his work becomes, instead of a task, a pleasure and an inspiration. If results may be regarded as a sufficient indication, the method appears to be the best by which the pupil is taught, not only to read, but also to write and speak the language, and to understand it when spoken by others. These ends were quite impossible to attain within a brief period by the old systems; but very rapid acquirements of the learner, according to the new method, become possible from the opportunities offered of hearing and speaking the language several hours each day with a native teacher; thus conducing to a great familiarity with the new tongue, approaching as nearly as may be the advantages actually derivable from sojourn on foreign soil.

—A meeting of the trustees of the Peabody museum of archeology of Harvard university was held at the museum in Cambridge on the 20th inst. After an inspection of the several rooms, and the method of arrangement of the collections illustrating the development of mankind in early times in various parts of the world, and the arts and customs of existing races, the Hon. Robert C. Winthrop called the meeting to order, and, in very complimentary terms to the curator, expressed the satisfaction of the trustees with the methods adopted and results secured. Other members of the board also expressed their satisfaction with the appearance of the museum, and the work of the curator and his assistants; and, on motion of the Hon. Stephen Salisbury, Dr. Wheatland was requested to enter upon the records of the board an expression of the appreciation of the trustees of the work of the curator, and their perfect satisfaction with his arrangement of the collections.

Mr. S. H. Scudder called attention to the explorations which had been made under the auspices of the museum, of which the curator, Mr. F. W. Putnam, then gave a brief account, dwelling particularly on those by Dr. Metz and himself in the great mound of the Turner group, in the Little Miami valley, Ohio. On motion of Professor Asa Gray, the curator was requested to prepare a full account of the Ohio group, as soon as the exploration shall be completed, for publication by the museum, and also to present a paper on the same topic at the approaching meeting of the American association for the advancement of science, that these important explorations by the museum may be more widely known. In accepting this very pleasant duty, the curator stated that it would be necessary to obtain a thousand dollars at once, for the further promotion of the Ohio explorations, which were being conducted in the most thorough and scientific manner. John C. Phillips, Esq., the treasurer of the board, stated that there were no funds available for the purpose; but he thought the importance of the work warranted a call for subscriptions to aid the museum in this exploration, and said that he

would most willingly give a further contribution of two hundred dollars for the purpose. Mr. Salisbury offered another hundred dollars, and the curator was authorized to obtain additional subscriptions with the assistance of the trustees. Subscriptions can be made to J. C. Phillips, treasurer, State Street, Boston, to any of the trustees, or to the curator at the museum. Due credit for all contributions will be given in the annual reports of the trustees.

—The London health exhibition was very far from complete on the opening day. The dairy department, however, was in full work; many varieties of churn being in use, and butter at one shilling and ninepence per pound made before the visitors' eyes, if they had patience to wait for it. One dairy company had a cow in the stall to prove the genuine nature of the original material. Among the most interesting exhibits were some specimens of ensilage, — one from Lord Walsingham's, being in very good condition; and another from Lord Tollemache's, having been in the silo since June 13.

—A cable despatch from Dun Echt, June 21, announces an ephemeris of Tuttle's comet; but as yet it is not known whether the comet has been seen since the chance observation at Vienna, May 26. The ephemeris, as cabled, is as follows:—

Date.	Right Ascension.	Declination.	Light.
	<i>h. m. s.</i>	<i>deg. min.</i>	
June 21	17 23 04	+23 51	1.16
June 25	17 21 00	+27 01	—
June 29	17 19 20	+25 09	—
July 3	17 18 36	+23 14	0.80

On neither of the probable returns of this comet, since its discovery by Mr. H. P. Tuttle at the Harvard observatory in 1858, has it been seen.

—At the meeting of the Society of arts, held on May 14, a new word was brought into currency by Professor Fleming Jenkins, who read a paper on 'Telephering,' which he defined as a designation of all modes of transport effected automatically by the aid of electricity. The particular scheme under consideration was the forwarding vehicles by means of electricity along a single suspended wire or rod. Here a model was shown consisting of two concentric octagons of wire, round which two trains steadily ran. The lecturer denied that the plan was intended to compete with steam or ordinary electric railways: it was merely intended as a mode of transporting heavy goods. The cost, he calculated, after allowing for maintenance and outlay, would be twopence per ton per mile. Where railways did not exist, and might not promise to pay the cost of construction, he thought he might with confidence predict that this invention would prove of value.

—A bronze equestrian statue of Gen. Dufour was erected on the Place Neuve at Geneva, Switzerland, on the 2d of June. The president and other notabilities of the confederation were present, together with an immense concourse of people. The success

of the occasion was enhanced by one of those beautiful days of spring for which Switzerland is so justly celebrated.

Guillaume Henri Dufour (born at Constance in 1787; died at Geneva the 14th of July, 1875) is the most conspicuous figure of Switzerland during the nineteenth century. His popularity as a general who three times commanded the Swiss army — twice under very trying circumstances, such as the civil war of the 'Sonderbund' in 1847, and the Prussian war-pressure of 1855-56 — is well deserved. He will also be remembered as the president of the first international congress of the Red cross society. But it is as a *savant* that we shall consider him. The orator of the day, Col. Aubert, president of the committee of the monument, said, "As a topographical engineer, he conceived, directed, and executed for the confederation that splendid map of Switzerland which leaves far behind it all that had previously been done of the same kind, reaching a perfection which has been copied, perhaps attained, but never yet surpassed," — a just appreciation of so distinguished a topographer.

Dufour's map, the official 'Carte topographique de la Suisse,' in twenty-five sheets (scale 1 : 100,000), is a true *chef-d'oeuvre*, a veritable model. A reduction in four sheets, on the scale of 1 : 250,000, also constructed under his direction, is a still more exquisite specimen of topography. We should be glad to see our government follow the lead of the Swiss republic, and give to its citizens, and to the scientific, agricultural, industrial, and commercial world, such a boon as a topographical atlas of the entire country, on the scale of 1 : 100,000, and thus supply an actual need of the present time.

The geodetic triangulation of Switzerland was begun by Dufour in 1832; and by agreement with the Piedmontese and French governments, which had undertaken a similar triangulation, the summit of the mountain of La Dôle, in the Jura, was considered as the terminal point of the three surveys. Major Delcros, of the topographical corps of the French engineers, starting from Havre and Paris as a base, was the last to finish its work: the two other observers had taken for the bases of their triangles, one, the shores of the Lake of Constance and the valley of the Upper Rhine, and the other the plains of the River Po; and to their delight, on comparing notes with Delcros, a difference of less than three metres was found for the elevation of the summit of La Dôle above the level of the sea, — a very remarkable case of exactness, when we consider the time and means; for it was long before the electric telegraph, the prismatic-light observations, and the very perfect instruments now in use.

— Dr. Dominik Kammel von Hardegger, a wealthy Austrian and eager sportsman, proposes to start in the ensuing autumn for Harar and the Somal country. He will be accompanied by Dr. Philipp Paulitschke, professor of geography at the University of Vienna, who has just published 'Die geographische erforschung der Adal-länder und Harar's' (Leipzig, *Frohberg*), an elaborate essay on the geographical

exploration of the countries which the expedition is likely to visit.

— We learn from *Nature* of June 12 that a new scheme of a polar expedition has been recently submitted by several officers of the Russian navy to the minister, Admiral Shestakoff. Starting from the idea that it is impossible to reach the north pole by sea on account of the archipelagoes that cover the circumpolar region, the Russian officers propose to start an expedition on sledges from the New Siberia Islands, which are nine hundred nautical miles distant from the pole. This space is to be covered by sledge-parties, who would make depots of provisions on the newly-discovered islands, and thus slowly but surely advance towards the north, securing at the same time the return journey of the expedition. When elaborated, the scheme will be submitted to the learned societies, and the necessary money raised by subscriptions.

— The death of Dr. Robert Angus Smith, on May 12 will be a great loss to science, as well as to a large circle of friends to whom his kind heart and sympathetic nature had endeared him. Dr. Angus Smith was born near Glasgow, Feb. 15, 1817. He was educated first at Glasgow, then studied chemistry at Giessen, under Liebig, from 1839 to 1841. A report which he presented to the British association in 1848, on the air and water of towns, gave a great impulse to the question at that time; and a paper on the air of towns, in the *Journal of the chemical society* of 1858, first produced data establishing the differences of the town and country air, wherever found. His latest discovery, by which he tested the amount of injurious gas likely to arise from water more or less contaminated with sewage, was noted in *Science* only a few months ago. Dr. Angus Smith was for many years government inspector of chemical works, and had been a member of the Royal society since 1857.

— The Milan society for the commercial exploration of Africa has organized a circumnavigation of Africa, with a view of affording the pupils of the High school of commerce, and others, an opportunity of becoming acquainted with likely markets for Italian products. The steamer will leave Genoa on the 1st of September, and the whole voyage will occupy four months. A professor is to lecture during the voyage on the commercial geography of Africa.

— Stanley's note-book of his Kongo experiences from the 24th of August, 1883, to January, 1884, has been published in Brussels. He gives an account of the important expedition from Stanley Pool to Stanley Fall, which solved a geographical problem. He followed the Kongo to the mouth of the Aronhonimi; and his explorations established the identity of that stream with the Quené, which was discovered by Schweinfurth. The banks are thickly populated, but the people not warlike; and the villages are rich in ivory and other African products. The style of architecture is different from that on the banks of the Kongo. Stanley met with no opposition, though he encountered a fleet of above a thousand boats. He reports that the condition of the settlement of the

International society is very satisfactory, and Leopoldville increasing rapidly.

— The report of the Ohio meteorological bureau for April gives, in addition to the usual statistical tables for its twenty odd stations, a descriptive account of the Jamestown tornadoes of April 27, by E. H. Mark, secretary. There seem to have been two adjacent but separate tornadoes, moving easterly about sixty miles an hour. One of them had a path about seven miles long; and the other, thirty miles, of which eleven miles were skipped over without damage. The width of the paths varied from two hundred feet to a quarter of a mile. Rain and hail fell to one side of the track, and sometimes on the track as well; but it is not stated whether the latter happened before, during, or after the passage of the funnel-cloud. About three hundred buildings were destroyed or damaged, besides many smaller outhouses and sheds of which no note was taken; and five persons were killed. Trees four feet in diameter were snapped off like twigs; cows were lifted over fences, and whirled around in the air; an iron bar six feet long, and weighing about a hundred pounds, was carried a hundred and fifty feet across a canal, and lodged in the fork of a tree. The violent action of the first tornado began at the meeting of two clouds, — a heavy, dark cloud from the south-west; and a light, yellow one from the north-west. A witness of their combat said, 'The dark cloud whipped the yellow one.' The ordinary funnel-cloud was formed from their union, and performed all the usual freaks, swaying from side to side, 'bounding over the country,' rising and falling 'like a ball attached to a rubber cord.' It is to be regretted, that, in the description of the apparent movements of the cloud, forms of expression are used that imply a downward motion. An abstract of Mr. Finley's characteristics of tornadoes is appended, both to call attention to the observations that should be made on passing storms, and to point out how their danger may be best avoided.

— The May number of the *Journal of the anthropological institute* contains President Flower's address on the aims and prospects of the study of anthropology. The great difficulty of the study of anthropology, he said, is the multifarious nature of the branches of knowledge comprehended under the title. The most important elements of difference between races are: 1°, structural characters; 2°, mental and moral characters; 3°, language; 4°, social customs. All these should be carefully studied by those who have any share in the government of people belonging to races alien to themselves.

— Mr. W. F. Denning of Bristol has computed, from his own observations made in the early part of 1869, and in February of the present year, a new value of the rotation-period of the planet Mars. He observed the central meridian passages of the 'hour-glass,' or 'Kaiser Sea,' as being the most prominent and suitable feature on the planet for such comparisons; and the result of his discussion gives, for the sidereal rotation-period of Mars, $24^h 37^m 22^s.34$, the interval covering 5,349 rotations. This period is in

good agreement with those derived by Kaiser, Schmidt, and Proctor, from much longer series of observations. Mr. Denning also collects the principal previous determinations of this constant, and has, in all, six values (all within 0.6 of each other), the mean of which is $24^h 37^m 22^s.626$. This corresponds to a daily rate of $350^{\circ}.8922$.

— Mr. Sereno E. Bishop of Honolulu has added sixteen pages to the Krakatoa literature in a little paper on the 'equatorial' smoke-stream from Krakatoa, in which he wishes to call more especial attention to a phenomenon consequent on the great eruption, that he thinks has not received sufficient notice. This is the "swift, strong fling from the eruptive column of Krakatoa of a vast stream of smoke, due west with great precision along a narrow equatorial belt at an enormous velocity, nearly around the globe." If the facts as here stated are fully confirmed, there will certainly be a remarkably rapid westward propagation of sunset effects to be explained; but the method of explanation suggested by Mr. Bishop is very unsatisfactory in assuming a limit to the atmosphere at forty-five miles altitude. Beginning with this unwarranted assumption, the author supposes that the volcanic gases, vapors, and finest dust would form a flat, conical accumulation over the point of eruption and above the atmosphere. Down the slopes of this flat cone, the gases would slide with accelerated velocity, but chiefly to the westward on account of lagging behind the meridian of eruption (the lagging is given as twenty-six miles an hour at an elevation of a hundred miles, but should be fifty-two miles an hour); and thus the rapid westward propagation of the sunsets can be accounted for. There can be no question as to the *tendency* to action somewhat in the manner here suggested; but whether this tendency will be fully realized is very questionable, unless decidedly greater elevations than a hundred miles were reached. The presence of some thin remnant of an atmosphere, even above a hundred miles, is demanded by observations on meteorites; and the condensation of volcanic vapors at that altitude would be very rapid. The neglect of these facts is a serious weakness in Mr. Bishop's theory.

— Honolulu papers of latest date report a renewal of the red sunsets.

— The new *Zeitschrift für wissenschaftliche mikroskopie und für mikroskopische technik*, edited by Dr. W. J. Behrens of Göttingen, makes a good impression by its first number, being very attractively printed, and having good contents. There are eight original articles upon various practical matters, a series of abstracts of the important recent contributions to microscopical technique, and several reviews of books lately published. Now that the art of preparing objects and using the instrument has progressed in so many directions, microscopical science needs a journal devoted to technique; and we trust this new suitor for subscriptions will find support to make it thrive. The present number of the *Zeitschrift* contains a list of papers referring to matters of microscopical technique, and published between Jan. 1 and Dec. 1, 1883. Hereafter the lists will be quarterly.

— The principal question to be discussed in Geneva, at the summer congress of the Red cross society, is the neutrality of hospital ships.

— John A. Ryder has reprinted, from the annual report of the U. S. fish-commission for 1882, a long essay with several plates on the embryology of teleosts. The author brings forward many interesting observations, and shows evident familiarity with the literature of the subject, although he does not appear to always judge the value of previous publications correctly; for instance, when he quotes Hoffmann's observations on segmentation. He has a little eccentricity of nomenclature, writing of 'embryography,' 'yelk,' etc., and applying the term 'germ-layer,' not to any part of the germ, but to the ectoplasm of the ovum! The essay contains a certainly unnecessary number of lengthy extracts and abstracts from earlier writers. Why must there be so much padding in our government publications? We must condole with Mr. Ryder on his plates, for the care and skill he displays in drawing are sadly obliterated by the photo-engravings. We can only protest against the blind infatuation with which the fish-commission rejects all good means of illustration, and insists upon the exclusive use of process cuts, which represent very few things well, and are the worst possible means of representing delicate and transparent embryos.

The essay itself contains many valuable observations. By an amusing inadvertence, New-York harbor is said to be filled with a unique fluid; for its waters "were found to have *less than half* the normal average specific gravity of those of the open sea"! The italics are ours. Ryder has studied principally the ovarian ova, the formation of the germinal disk, segmentation, the formation of the neurula, and as much of the organogeny as can be followed out upon the transparent embryo. The work has been done with evident care and patience, and is to be supplemented by further researches, partly by the aid of sections. The observations made as to the formation of the germinal disk, the relations of the vitelline sac, the development of the ribs, muscle-plates, and fins, may be signalized as being of especial interest and importance. It must be doubted, however, whether Ryder's view as to the significance of what he strangely calls the 'yelk hypoblast' can be accepted.

— The report of the entomologist, published in the last report of the U. S. commissioner of agriculture, contains an account of the lepidopterous insects which infest cabbage in this country; a report on the causes of destruction of evergreen forests in northern New England, and New York, by Professor Packard; a report of progress in experiments in the destruction of scale insects, by H. G. Hubbard; and accounts of the imported elm-beetle, and the lesser migratory locust. The report is illustrated by thirteen full-page plates, about one-half of which are original.

— At the meeting of the Royal geographical society, held in London on May 12, it was announced that gold medals had been awarded to Mr. A. Colquhoun and Dr. Julius Haast. That given to Mr. Colquhoun as for his journey from Canton to the Trawadi at

Rhamo in 1882, during which he executed surveys of the whole route from Wa-Chan (a hundred and fifty miles west of Canton) to Talifu, thirteen hundred miles of which had never before been surveyed. The medal to Dr. Haast was in consideration of his systematic explorations of the southern islands of New Zealand, — in the course of which he ascertained the altitudes of a hundred and thirty stations, and collected material for a map, the manuscript of which he presented to the society, — and for his numerous contributions to our knowledge of New Zealand.

— The Albert medal of the Society of arts has been awarded by the council of the society, with the approval of the Prince of Wales (the president), to Capt. James Buchanan Eads, "the American engineer, whose works have been of great service in improving the water communications of North America, and have thereby rendered valuable aid to the commerce of the world."

— Herr Ernst von Hesse Wartegg is starting on an exploring expedition in Mexico and Central America to collect material for his new work on the archeology of those regions.

— Reports from Cape Colony state that Dr. Holub's plans are approaching success, in spite of his early difficulties with the colonial customs-house, which demanded duty on his explorer's outfit and scientific instruments. The aid sent from Europe has enabled him to cross the Transvaal, and enter the interior of Africa from there. During his involuntary stay in Cape Town, he explored the Somerset Mountains, where he made some interesting ornithological studies, and despatched specimens to Europe. The collections of the fauna and flora of South Africa, which he intends to make on his wanderings, he has promised to divide among the societies which have contributed to the expenses of the expedition.

— The twelfth annual session of the American public health association will be held Oct. 14-17, 1884, at St. Louis, Mo., and the following topics are proposed for consideration: Hygiene of the habitations of the poor, Hygiene of occupations, School hygiene, Adulteration of food, Water-pollution, Disposal of sewage by irrigation or chemical action, The observable effect upon the public health of official sanitary supervision, The work of municipal and state boards of health. Extensive preparations are now under way for making this the largest meeting that the association has ever held; and the committee urge the attendance and co-operation of persons in all trades and professions, interested in the advancement of public health and general sanitary science.

— Mr. G. F. Kunz, at the meeting of the New-York academy of sciences, May 19, exhibited a yellowish-green cut gem of fluorite chlorophane, from Hunter county, Va., and remarked, that, although too soft for gem purposes, this stone was possibly the first gem cut that phosphoresced without any great heating. The gem was passed around in a vial of warm water, and in the dark showed a very plain pale-green light.



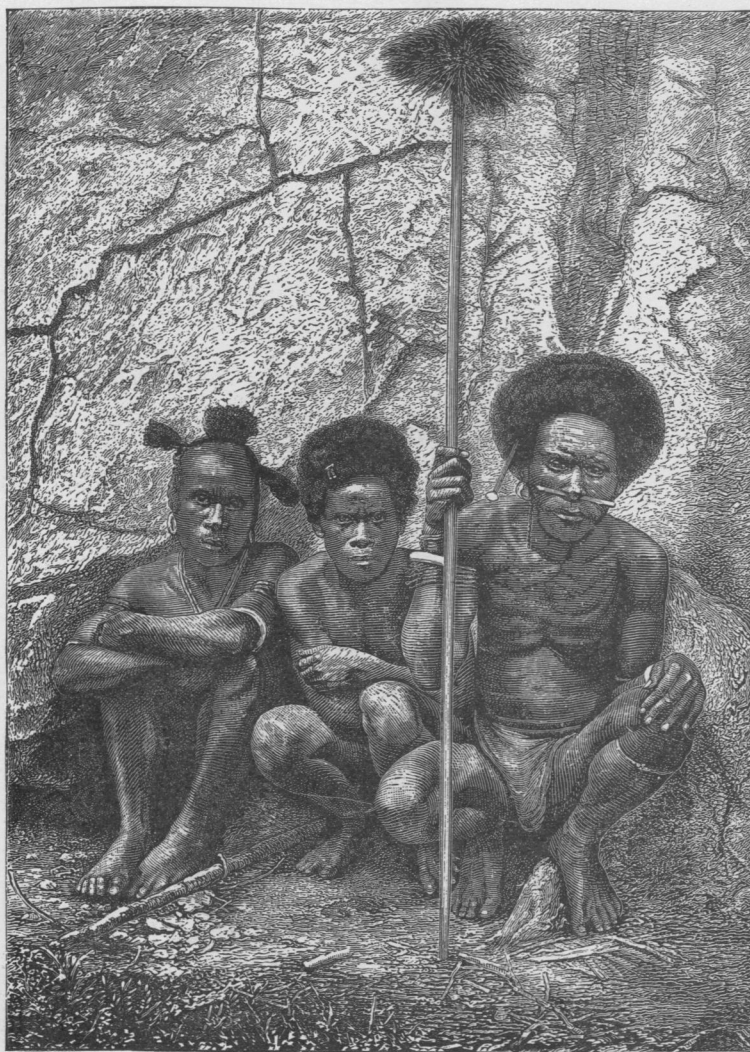
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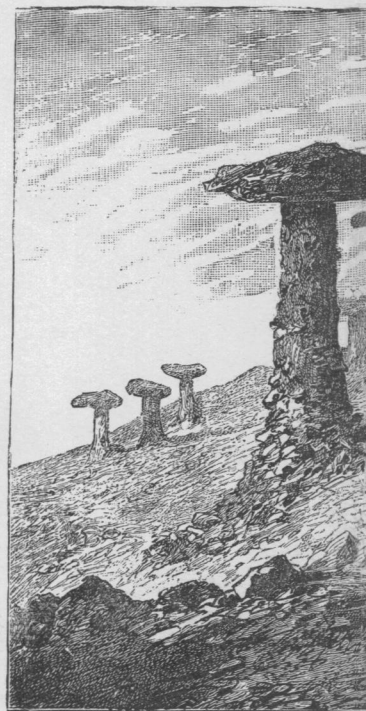
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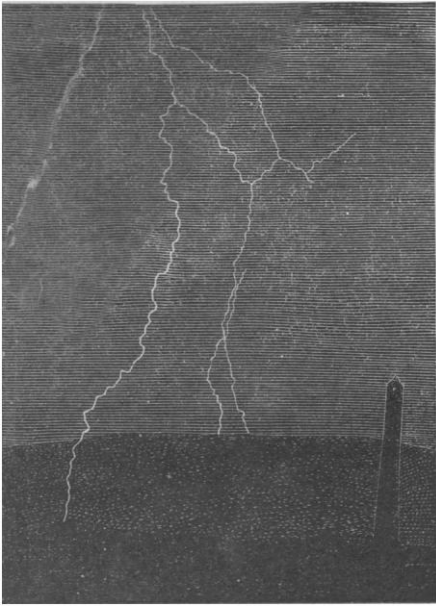


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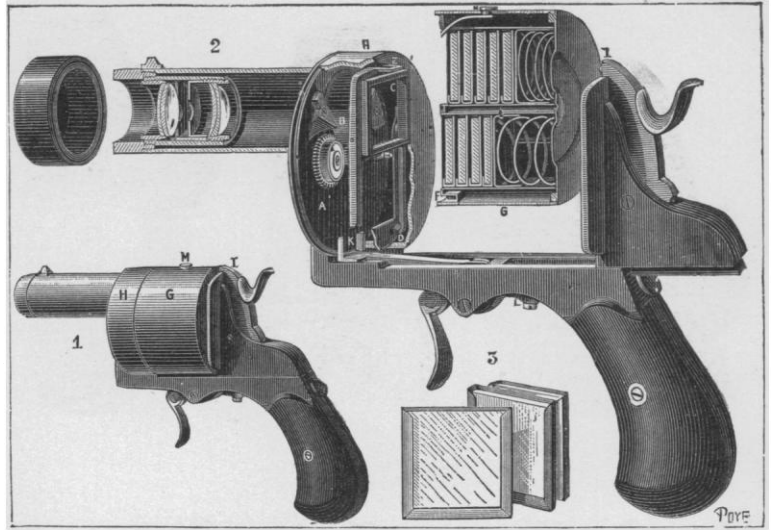


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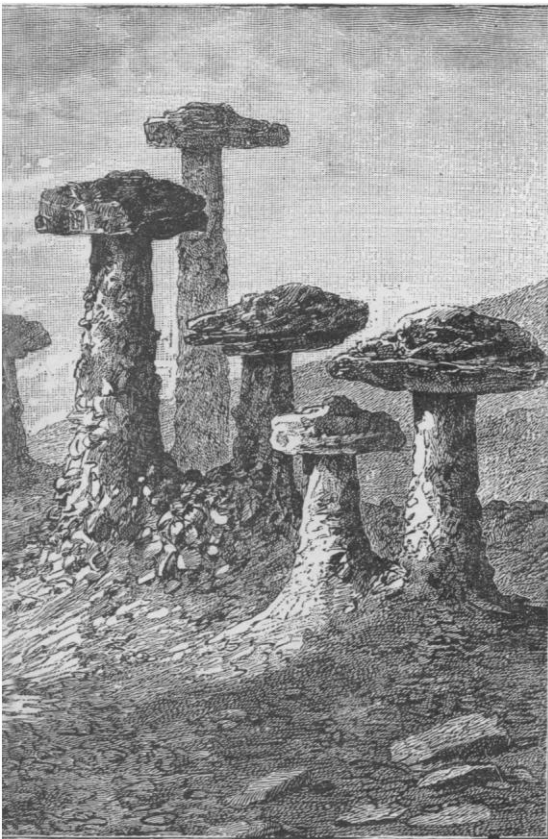


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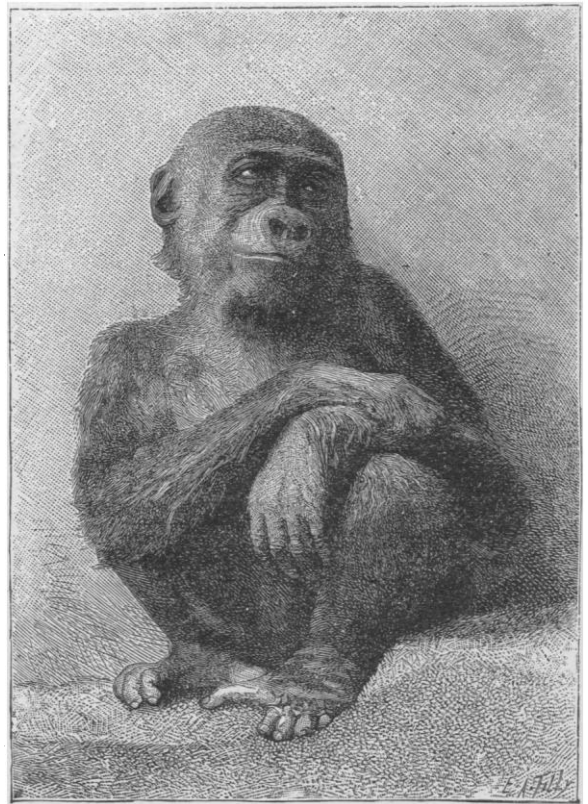


PHOTOGRAPHIC REVOLVER FOR INSTANTANEOUS PHOTOGRAPHY.

A, the shutter rotated by clock-work when the catch B is released from the teeth K by pressure on the trigger. After a plate has been exposed in the holder C, the barrel G is revolved by hand; and, the catch E being released by the inclined plane at F, the plate is transferred to the chamber for exposed plates (shown below in the figure). By continued rotation, the chamber of fresh plates is brought opposite the holder, and another plate pressed by the spring into the holder. — *La Nature*.



THE PILLARS OF JAGNAOUS, KOHISTAN. — *La Nature*.



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ERRATA.

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| <p>Page 26, col. 2, 27th line from bottom, for 'Nat-sis-áú' read 'Nat-sis-áñ.'</p> <p>" 26, " 2, 10th line from bottom, for 'Mo-eu-kap-i' read 'Mo-en-kap-i.'</p> <p>" 67, " 1, 26th line from bottom, for 'Eutania' read 'Eutaenia.'</p> <p>" 137, " 1, line 9, for 'calciferous' read 'calciferus.'</p> <p>" 188, " 2, lines 4 and 14, for 'Cullie' read 'Sands.'</p> <p>" 189, " 1, line 6, for 'Cullie' read 'Sands.'</p> <p>" 216, " 1, lines 1 and 2, omit 'an abundance of macrospores, besides.'</p> <p>" 296, " 2, 4th line from bottom, for 'Dendroica' read 'Dendroeca.'</p> <p>" 316, " 2, 14th line from bottom, for 'm' read 'k.'</p> <p>" 337, " 2, 20th line from bottom, for 'larval' read 'larvae.'</p> <p>" 345, " 1, line 3, for 'Bredicton' read 'Bredichin.'</p> <p>" 394, " 1, 18th line from bottom, for 'Coriacus' read 'Cariacus.'</p> | <p>Page 494, col. 2, 14th line from bottom, for 'caniliculata' read 'canaliculata.'</p> <p>" 648, " 2, line 24, for 'Mytalus' read 'Mytilus.'</p> <p>" 693, " 2, 2d paragraph. The rocks mentioned did not come from the Silver-Cliff district, but from the same locality as the specimens mentioned on p. 667, col. 1, 2d paragraph.</p> <p>" 723, " 2, 13th line from bottom, for 'deodorizing' read 'odorizing.'</p> <p>" 737, " 1, 8th line from bottom, for 'Mayenia' read 'Meyenia.'</p> <p>" 740, " 1, 4th line from bottom, for 'on' read 'and.'</p> <p>" 795, " 2, line 21, for 'a hundred and twenty-four' read 'thirty-six.'</p> <p>" 796, " 2, line 6, for 'a hundred and ninety three' read 'two hundred and thirteen.'</p> <p>" 799, " 2, 22d line from bottom, for 'telepherage' read 'telpherage.'</p> |
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